



## SEQUENCE LISTING

<110> Microbial Technics Limited  
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Hanniffy, Sean B  
Hansbro, Philip M

<120> Proteins

<130> PWC/P21122WO

<140> PCT/GB99/02452

<141> 1999-07-27

<150> GB 9816336.3

<151> 1998-07-27

<150> US 60/125329

<151> 1999-03-19

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<170> PatentIn Ver. 2.1

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| Gly | Ile | Ser | Val | Gly | Ile | Gly | His | Leu | Gln | Gly | Ser | Ser | Met | Ala | Lys |
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| Asn | Asn | Lys | Val | Ala | Val | Val | Thr | Thr | Val | Pro | Ser | Val | Ala | Glu | Gly |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |
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|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |
| Asp | Gln | Glu | Asp | Ser | Val | Leu | Lys | Ala | Val | Tyr | His | Gly | Glu | Thr | Ser |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |
| Leu | Glu | Asn | Gly | Ile | Lys | Phe | Glu | Val | Thr | Gly | Thr | Leu | Asn | Glu | Leu |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Gln | Asn | Gln | Leu | Asn | Arg | Ser | Thr | Ala | Ser | Leu | Ser | Gln | Glu | Gln | Glu |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
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|     |     |     | 165 |     |     |     |     | 170 |     |     |     |     |     | 175 |     |
| Phe | Phe | Leu | Tyr | Met | Ile | Leu | Ile | Thr | Tyr | Ala | Gly | Val | Thr | Ala | Gln |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Glu | Val | Ala | Ser | Glu | Lys | Gly | Thr | Lys | Ile | Met | Glu | Val | Val | Phe | Ser |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| Ser | Ile | Arg | Ala | Ser | His | Tyr | Phe | Tyr | Ala | Arg | Met | Met | Ala | Leu | Phe |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
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|     |     | 260 |     |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| Leu | Ile | Ser | Leu | Phe | Met | Tyr | Val | Val | Leu | Ala | Ala | Phe | Leu | Gly | Ser |
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| Met | Val | Ser | Arg | Pro | Glu | Asp | Ser | Gly | Lys | Ala | Leu | Ser | Pro | Leu | Met |

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
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| Val | Ile | Ser | Ala | Tyr | Asn | Glu | Glu | Lys | Tyr | Leu | Pro | Gly | Leu | Ile | Glu |  |  |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |  |  |
| Asp | Leu | Lys | Asn | Gln | Thr | Tyr | Pro | Lys | Glu | Asp | Ile | Glu | Ile | Leu | Phe |  |  |
|     |     | 50  |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |  |  |
| Ile | Asn | Ala | Met | Ser | Thr | Asp | Gly | Thr | Thr | Ala | Ile | Ile | Gln | Gln | Phe |  |  |
|     | 65  |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |  |
| Ile | Lys | Glu | Asp | Thr | Glu | Phe | Asn | Ser | Ile | Arg | Leu | Tyr | Asn | Asn | Pro |  |  |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |  |  |
| Lys | Lys | Asn | Gln | Ala | Ser | Gly | Phe | Asn | Leu | Gly | Val | Lys | His | Ser | Val |  |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |  |
| Gly | Asp | Leu | Ile | Leu | Lys | Ile | Asp | Ala | His | Ser | Lys | Val | Thr | Glu | Thr |  |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     |     | 125 |     |     |  |  |
| Phe | Val | Met | Asn | Asn | Val | Ala | Ile | Ile | Gln | Gln | Gly | Glu | Phe | Val | Cys |  |  |
|     |     | 130 |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |  |
| Gly | Gly | Pro | Arg | Pro | Thr | Ile | Val | Glu | Gly | Lys | Gly | Lys | Trp | Ala | Glu |  |  |
|     | 145 |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |  |
| Thr | Leu | His | Leu | Val | Glu | Glu | Asn | Met | Phe | Gly | Ser | Ser | Ile | Ala | Asn |  |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |  |
| Tyr | Arg | Asn | Ser | Ser | Glu | Asp | Arg | Tyr | Val | Ser | Ser | Ile | Phe | His | Gly |  |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |  |
| Met | Tyr | Lys | Arg | Glu | Val | Phe | Gln | Lys | Val | Gly | Leu | Val | Asn | Glu | Gln |  |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |  |
| Leu | Gly | Arg | Thr | Glu | Asp | Asn | Asp | Ile | His | Tyr | Arg | Ile | Arg | Glu | Tyr |  |  |
|     |     | 210 |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |  |
| Gly | Tyr | Lys | Ile | Arg | Tyr | Ser | Pro | Ser | Ile | Leu | Ser | Tyr | Gln | Tyr | Ile |  |  |
|     | 225 |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |  |
| Arg | Pro | Thr | Phe | Lys | Lys | Met | Leu | His | Gln | Lys | Tyr | Ser | Asn | Gly | Leu |  |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |  |
| Trp | Ile | Gly | Leu | Thr | Ser | His | Val | Gln | Phe | Lys | Cys | Leu | Ser | Leu | Phe |  |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |  |
| His | Tyr | Val | Pro | Cys | Leu | Phe | Val | Leu | Ser | Leu | Val | Phe | Ser | Leu | Ala |  |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |  |
| Leu | Leu | Pro | Ile | Thr | Phe | Val | Phe | Ile | Thr | Leu | Leu | Leu | Gly | Ala | Tyr |  |  |
|     |     | 290 |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |  |
| Phe | Leu | Leu | Leu | Ser | Leu | Leu | Thr | Leu | Leu | Thr | Leu | Leu | Lys | His | Lys |  |  |
|     | 305 |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |  |



Asn Gly Phe Leu Ile Val Met Pro Phe Ile Leu Phe Ser Ile His Phe  
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Ala Tyr Gly Leu Gly Thr Ile Val Gly Leu Ile Arg Gly Phe Lys Trp  
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Ile Asn Gln Asn Met Leu  
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Tyr Thr Ser Thr Thr Arg Ile Tyr Val Val Asn Arg Asn Gln Gly Asp  
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Lys Pro Gly Leu Thr Asn Gln Asp Leu Gln Ala Gly Thr Tyr Leu Val  
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Lys Asp Tyr Arg Glu Ile Ile Leu Ser Gln Asp Val Leu Glu Glu Val

85

90

95

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 Ile Lys Val Thr Val Pro Val Asp Thr Arg Ile Val Ser Ile Ser Val  
 115 120 125  
 Asn Asp Arg Val Pro Glu Glu Ala Ser Arg Ile Ala Asn Ser Leu Arg  
 130 135 140  
 Glu Val Ala Ala Gln Lys Ile Ile Ser Ile Thr Arg Val Ser Asp Val  
 145 150 155 160  
 Thr Thr Leu Glu Glu Ala Arg Pro Ala Ile Ser Pro Ser Ser Pro Asn  
 165 170 175  
 Ile Lys Arg Asn Thr Leu Ile Gly Phe Leu Ala Gly Val Ile Gly Thr  
 180 185 190  
 Ser Val Ile Val Leu His Leu Glu Leu Leu Asp Thr Arg Val Lys Arg  
 195 200 205  
 Pro Glu Asp Ile Glu Asn Thr Leu Gln Met Thr Leu Leu Gly Val Val  
 210 215 220  
 Pro Asn Leu Gly Lys Leu Lys  
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&lt;211&gt; 555

&lt;212&gt; DNA

&lt;213&gt; Streptococcus pneumoniae

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&lt;211&gt; 184

&lt;212&gt; PRT

&lt;213&gt; Streptococcus pneumoniae

&lt;400&gt; 8

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                   65                                  70                                  75                                  80  
 Thr Leu Ile Gln Glu Leu Gln Ser Phe Glu Gln Glu Gly Lys Lys Leu  
                                   85                                  90                                  95  
 Ala Ala Ile Cys Ala Ala Pro Ile Ala Leu Asn Gln Ala Glu Ile Leu  
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<210> 12  
 <211> 314  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 12  
 Met Phe Leu Lys Lys Glu Arg Glu Val Ile Ser Met Arg Lys Trp Thr  
                     1                      5                      10                      15  
 Lys Gly Phe Leu Ile Phe Gly Val Val Thr Thr Val Ile Gly Phe Ile  
                     20                      25                      30

Leu Leu Phe Val Gly Ile Gln Ser Asp Gly Ile Lys Ser Leu Leu Ser  
 35 40 45  
 Met Ser Lys Glu Pro Val Tyr Asp Ser Arg Thr Glu Lys Leu Thr Phe  
 50 55 60  
 Gly Lys Glu Val Glu Asn Leu Glu Ile Thr Leu His Gln His Thr Leu  
 65 70 75 80  
 Thr Ile Thr Asp Ser Phe Asp Asp Gln Ile His Ile Ser Tyr His Pro  
 85 90 95  
 Ser Leu Ser Ala His His Asp Leu Ile Thr Asn Gln Asn Asp Arg Thr  
 100 105 110  
 Leu Ser Leu Thr Asp Lys Lys Leu Ser Glu Thr Pro Phe Leu Ser Ser  
 115 120 125  
 Gly Ile Gly Gly Ile Leu His Ile Ala Ser Ser Tyr Ser Ser Arg Phe  
 130 135 140  
 Glu Glu Val Ile Leu Arg Leu Pro Lys Gly Arg Thr Leu Lys Gly Ile  
 145 150 155 160  
 Asn Ile Ser Ala Asn Arg Gly Gln Thr Thr Ile Ile Asn Ala Ser Leu  
 165 170 175  
 Glu Asn Ala Thr Leu Asn Thr Asn Ser Tyr Ile Leu Arg Ile Glu Gly  
 180 185 190  
 Ser Arg Ile Lys Asn Ser Lys Leu Thr Thr Pro Asn Ile Val Asn Ile  
 195 200 205  
 Phe Asp Thr Val Leu Thr Asp Ser Gln Leu Glu Ser Thr Glu Asn His  
 210 215 220  
 Phe His Ala Glu Asn Ile Gln Val His Gly Lys Val Glu Leu Thr Ala  
 225 230 235 240  
 Lys Asp Tyr Leu Arg Ile Ile Leu Asp Gln Lys Glu Ser Gln Arg Ile  
 245 250 255  
 Asn Trp Asp Ile Ser Ser Asn Tyr Gly Ser Ile Phe Gln Phe Thr Arg  
 260 265 270  
 Glu Lys Pro Glu Ser Arg Gly Thr Glu Leu Ser Asn Pro Tyr Lys Thr  
 275 280 285  
 Glu Lys Thr Asp Val Lys Asp Gln Leu Ile Ala Arg Ser Asp Asp Asn  
 290 295 300  
 Ile Asp Leu Ile Ser Thr Pro Ser Arg Arg  
 305 310

<210> 13  
 <211> 879  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 13  
 atgaaacaag aatgggttga aagtaatgat tttgtaaaa caacaagcaa gaacaagcct 60  
 gaagagcaag ctcaagaggt tgcagacaag gctgaagaaa cgatagccga tctcgataca 120  
 ccaattgaaa aaaataactca gttagaggag gaagtccttc aagctgaagt cgaattggaa 180  
 agccagcaag aagagaaaaat tgaagctcct gaagacagtg aagcgagAAC agaaatagaa 240  
 gaaaagaagg catctaattc tactgaagaa gagccagacc tttctaaaga aacagaaaaa 300  
 gtcactatag ctgaagagag ccaagaagct cttcctcagc aaaaagcaac cacgaaagag 360  
 ccacttctta tcagtaaattc tttagaaagt ctttatatcc ccgaccaagc tccaaaatct 420  
 agggataaat ggaaagagca agtgcttgat ttttggctct ggctagtggg agcgatcaaa 480  
 tctctacaaa gtaagttgga aacaagtatc acacacagtt acacagcctt tctcttgctc 540  
 attctgtttt ctgcatcttc ctttttcttt agtatctatc acatcaaaca tgcttactat 600  
 ggacatatag caagcattaa cagtcgcttc cctgagcagc tagctccttt aactcttttt 660  
 tctatcatct ctatcctagt agcgacaaca ctcttcttct tttcattcct cttgggtagt 720  
 ttcgttgtga gacgatttat ccaccaggaa aaggactgga cgctagacaa ggttctccaa 780  
 caatatagtc aactcttggc aattccaatc tcctcactgc tattgctagt ttctttgctt 840  
 tctttgatag cctacgattt acagccctct tgtgtgtga 879

<210> 14  
 <211> 292  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 14  
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 1 5 10 15  
 Lys Asn Lys Pro Glu Glu Gln Ala Gln Glu Val Ala Asp Lys Ala Glu  
 20 25 30  
 Glu Thr Ile Ala Asp Leu Asp Thr Pro Ile Glu Lys Asn Thr Gln Leu  
 35 40 45  
 Glu Glu Glu Val Pro Gln Ala Glu Val Glu Leu Glu Ser Gln Gln Glu  
 50 55 60  
 Glu Lys Ile Glu Ala Pro Glu Asp Ser Glu Ala Arg Thr Glu Ile Glu  
 65 70 75 80  
 Glu Lys Lys Ala Ser Asn Ser Thr Glu Glu Glu Pro Asp Leu Ser Lys  
 85 90 95  
 Glu Thr Glu Lys Val Thr Ile Ala Glu Glu Ser Gln Glu Ala Leu Pro  
 100 105 110  
 Gln Gln Lys Ala Thr Thr Lys Glu Pro Leu Leu Ile Ser Lys Ser Leu  
 115 120 125  
 Glu Ser Pro Tyr Ile Pro Asp Gln Ala Pro Lys Ser Arg Asp Lys Trp  
 130 135 140  
 Lys Glu Gln Val Leu Asp Phe Trp Ser Trp Leu Val Glu Ala Ile Lys

|   |     |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|-----|
| 145   |     | 150 |     | 155 |     | 160 |
| Ser Pro Thr Ser Lys Leu Glu Thr Ser Ile Thr His Ser Tyr Thr Ala   |     |     |     |     |     |     |
|   | 165 |     | 170 |     | 175 |     |
| Phe Leu Leu / Leu Ile Leu Phe Ser Ala Ser Ser Phe Phe Phe Ser Ile |     |     |     |     |     |     |
|   | 180 |     | 185 |     | 190 |     |
| Tyr His Ile Lys His Ala Tyr Tyr Gly His Ile Ala Ser Ile Asn Ser   |     |     |     |     |     |     |
|   | 195 |     | 200 |     | 205 |     |
| Arg Phe Pro Glu Gln Leu Ala Pro Leu Thr Leu Phe Ser Ile Ile Ser   |     |     |     |     |     |     |
|   | 210 |     | 215 |     | 220 |     |
| Ile Leu Val Ala Thr Thr Leu Phe Phe Phe Ser Phe Leu Leu Gly Ser   |     |     |     |     |     |     |
| 225   |     | 230 |     | 235 |     | 240 |
| Phe Val Val Arg Arg Phe Ile His Gln Glu Lys Asp Trp Thr Leu Asp   |     |     |     |     |     |     |
|   | 245 |     | 250 |     | 255 |     |
| Lys Val Leu Gln Gln Tyr Ser Gln Leu Leu Ala Ile Pro Ile Ser Ser   |     |     |     |     |     |     |
|   | 260 |     | 265 |     | 270 |     |
| Leu Leu Leu Leu Val Ser Leu Leu Ser Leu Ile Ala Tyr Asp Leu Gln   |     |     |     |     |     |     |
|   | 275 |     | 280 |     | 285 |     |
| Pro Ser Cys Val   |     |     |     |     |     |     |
| 290   |     |     |     |     |     |     |

<210> 15  
 <211> 990  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 15  
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 gaaagagagg taatcagcat gcgtaaattg acaaaaggat ttctcatctt tgggtgtggtg 120  
 actaccgtta tcggctttat cctgcttttt gtaggtatcc aatctgacgg gattaagagc 180  
 ctactttcca tgtccaaaga acctgtctat gatagccgta cggaaaagct aacctttggc 240  
 aaggaagtgc aaaacctaga aattactctc caccaacaca cgctcaccat cacagactct 300  
 ttcgatgatc aaatccacat ttcttaccat ccatctcttt ctgctcacca tgatcttate 360  
 accaatcaga acgatagaac tctgagtctc actgataaga aactgtctga aactccgttt 420  
 ctctcttctg gaattggtgg gattcttcat atcgcaagta gctactctag tcgttttgaa 480  
 gaagttattc tccgactacc aaaagggaga actctaaaag ggatcaacat ctgagccaat 540  
 cgcgacaaaa ccaccatcat aaatgctagc cttgaaaatg cgaccctcaa taaaaacagc 600  
 tatatctctc gaattgaagg aagtcgtatc aaaaacagta aactcacaac gcccaatatc 660  
 gttaatatct ttgatacagt tcttacagat agtcagctag agtcaacaga gaatcacttc 720  
 cagcgtgaaa atatccaagt ccatggcaag gttgaaactga ctgccaaaga ttatctcaga 780  
 atcatcctag accagaaaga aagccaacga attaactggg acatctcaag caactatggg 840  
 tctatcttcc aattcacaag agaaaagcct gaatcaagag gtacggaatt aagcaaccct 900  
 taaaaaactg aaaaaaccga tgtcaaggat caactcattg cgagatctga tgataaatatt 960  
 gatctaatat ccacaccaag cagacgttga 990

<210> 16

<211> 329

<212> PRT

<213> Streptococcus pneumoniae

<400> 16

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Met | Gln | Leu | Ala | Ser | Ser | Val | Tyr | Ser | Leu | Phe | Val | Trp | Tyr | Asn | Leu |  |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |  |
| Phe | Leu | Lys | Lys | Glu | Arg | Glu | Val | Ile | Ser | Met | Arg | Lys | Trp | Thr | Lys |  |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |  |
| Gly | Phe | Leu | Ile | Phe | Gly | Val | Val | Thr | Thr | Val | Ile | Gly | Phe | Ile | Leu |  |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |  |
| Leu | Phe | Val | Gly | Ile | Gln | Ser | Asp | Gly | Ile | Lys | Ser | Leu | Leu | Ser | Met |  |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |  |
| Ser | Lys | Glu | Pro | Val | Tyr | Asp | Ser | Arg | Thr | Glu | Lys | Leu | Thr | Phe | Gly |  |
|     | 65  |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |
| Lys | Glu | Val | Glu | Asn | Leu | Glu | Ile | Thr | Leu | His | Gln | His | Thr | Leu | Thr |  |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |  |
| Ile | Thr | Asp | Ser | Phe | Asp | Asp | Gln | Ile | His | Ile | Ser | Tyr | His | Pro | Ser |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |
| Leu | Ser | Ala | His | His | Asp | Leu | Ile | Thr | Asn | Gln | Asn | Asp | Arg | Thr | Leu |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |
| Ser | Leu | Thr | Asp | Lys | Lys | Leu | Ser | Glu | Thr | Pro | Phe | Leu | Ser | Ser | Gly |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |
| Ile | Gly | Gly | Ile | Leu | His | Ile | Ala | Ser | Ser | Tyr | Ser | Ser | Arg | Phe | Glu |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |
| Glu | Val | Ile | Leu | Arg | Leu | Pro | Lys | Gly | Arg | Thr | Leu | Lys | Gly | Ile | Asn |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |
| Ile | Ser | Ala | Asn | Arg | Gly | Gln | Thr | Thr | Ile | Ile | Asn | Ala | Ser | Leu | Glu |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |
| Asn | Ala | Thr | Leu | Asn | Thr | Asn | Ser | Tyr | Ile | Leu | Arg | Ile | Glu | Gly | Ser |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |
| Arg | Ile | Lys | Asn | Ser | Lys | Leu | Thr | Thr | Pro | Asn | Ile | Val | Asn | Ile | Phe |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |
| Asp | Thr | Val | Leu | Thr | Asp | Ser | Gln | Leu | Glu | Ser | Thr | Glu | Asn | His | Phe |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |
| His | Ala | Glu | Asn | Ile | Gln | Val | His | Gly | Lys | Val | Glu | Leu | Thr | Ala | Lys |  |
|     |     |     | 245 |     |     |     |     |     | 250 |     |     |     |     | 255 |     |  |
| Asp | Tyr | Leu | Arg | Ile | Ile | Leu | Asp | Gln | Lys | Glu | Ser | Gln | Arg | Ile | Asn |  |
|     |     | 260 |     |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |
| Trp | Asp | Ile | Ser | Ser | Asn | Tyr | Gly | Ser | Ile | Phe | Gln | Phe | Thr | Arg | Glu |  |



275                                      280                                      285  
 Lys Pro Glu Ser Arg Gly Thr Glu Leu Ser Asn Pro Tyr Lys Thr Glu  
       290                                      295                                      300  
 Lys Thr Asp Val Lys Asp Gln Leu Ile Ala Arg Ser Asp Asp Asn Ile  
 305                                      310                                      315                                      320  
 Asp Leu Ile Ser Thr Pro Ser Arg Arg  
                                     325

<210> 17  
 <211> 79  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 17  
 atgatatgta aatgaagca gggagggagc agggcgtgct ggggatggag agtgggggag 60  
 ggacgctgct attttaatc 79

<210> 18  
 <211> 26  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 18  
 Met Ile Cys Lys Met Lys Gln Gly Gly Ser Arg Ala Cys Trp Gly Trp  
       1                                      5                                      10                                      15  
 Arg Val Gly Glu Gly Arg Cys Tyr Phe Asn  
                                     20                                      25

<210> 19  
 <211> 715  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 19  
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 gattgggtcat aatggggctg gaaaatcgac cactataaaa tccctagtca gtatcatttc 120  
 acccagcagt ggtcgtatct tggtagacgg tcaggagtta tcggaaaatc gcttggctat 180  
 taaacgaaag attggctacg tagcagactc gcctgactta tttttacgct taacggccaa 240  
 tgaatttttg gaattgatcg cctcatccta tgatctgagt agatctgact tggaggctag 300  
 tctagctagg ctattgaacg tttttgattt tgctgaaaat cgctatcagg ttattgaaac 360  
 tctttctcac ggaatgcgtc agaaagtctt tgtcatcgga gcactcttgt ctgatcccga 420  
 tatttgggtt ttggacgaac ccttgactgg tttggatccc caggctgcct ttgatttgaa 480  
 acagatgatg aaggaacatg cacaaaaagg gaagacagtc ttgttttcaa ctcatgtcct 540  
 agaggtggca gagcaagtct gtgatcggat tgccattttg aaaaaggggc atttgattta 600  
 ttgtggttaag gtagaggact tgaggaaaga ccaccagac cagtctttgg aaagtatcta 660  
 ccttagtctt gctggtagaa aagaggaggt tgcggatgcg tctcaaggtc attaa 715

<210> 20  
 <211> 237  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 20  
 Asp Lys Glu Ala Leu Ser Asn Leu Asn Leu Gln Ile Glu Asn Gly Glu  
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 Lys Ser Leu Val Ser Ile Ile Ser Pro Ser Ser Gly Arg Ile Leu Val  
 35 40 45  
 Asp Gly Gln Glu Leu Ser Glu Asn Arg Leu Ala Ile Lys Arg Lys Ile  
 50 55 60  
 Gly Tyr Val Ala Asp Ser Pro Asp Leu Phe Leu Arg Leu Thr Ala Asn  
 65 70 75 80  
 Glu Phe Trp Glu Leu Ile Ala Ser Ser Tyr Asp Leu Ser Arg Ser Asp  
 85 90 95  
 Leu Glu Ala Ser Leu Ala Arg Leu Leu Asn Val Phe Asp Phe Ala Glu  
 100 105 110  
 Asn Arg Tyr Gln Val Ile Glu Thr Leu Ser His Gly Met Arg Gln Lys  
 115 120 125  
 Val Phe Val Ile Gly Ala Leu Leu Ser Asp Pro Asp Ile Trp Val Leu  
 130 135 140  
 Asp Glu Pro Leu Thr Gly Leu Asp Pro Gln Ala Ala Phe Asp Leu Lys  
 145 150 155 160  
 Gln Met Met Lys Glu His Ala Gln Lys Gly Lys Thr Val Leu Phe Ser  
 165 170 175  
 Thr His Val Leu Glu Val Ala Glu Gln Val Cys Asp Arg Ile Ala Ile  
 180 185 190  
 Leu Lys Lys Gly His Leu Ile Tyr Cys Gly Lys Val Glu Asp Leu Arg  
 195 200 205  
 Lys Asp His Pro Asp Gln Ser Leu Glu Ser Ile Tyr Leu Ser Leu Ala  
 210 215 220  
 Gly Arg Lys Glu Glu Val Ala Asp Ala Ser Gln Gly His  
 225 230 235

<210> 21  
 <211> 360  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 21  
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agacctatga tggttccgac gatagagatt aaaagagtga taccagcacc acgcaagagt 120  
tgttgccagt tttcagaaaag aatttttagca acttggctaa agaaactact gctagtctct 180  
tcagttgttg tagcttcggc aggttggtcc ttgatcatac gatccatcaa ggcaacttgg 240  
tcattctttg aaatggtttc aatgctggca ttgatttggc taatacgatt gtcattttta 300  
cgaagcccga tagcgatagc tgtatcttct tccccagttt tgaaaccagg ttctacttga 360

<210> 22

<211> 119

<212> PRT

<213> Streptococcus pneumoniae

<400> 22

Met Ala Leu Phe Ser Glu Arg Gly Ala Val Arg Lys Thr Pro Met Ala  
1 5 10 15

Ser Pro Ile Met Arg Pro Met Met Val Pro Thr Ile Glu Ile Lys Arg  
20 25 30

Val Ile Pro Ala Pro Arg Lys Ser Cys Cys Gln Phe Ser Glu Arg Ile  
35 40 45

Leu Ala Thr Trp Leu Lys Lys Leu Leu Leu Val Ser Ser Val Val Val  
50 55 60

Ala Ser Ala Gly Cys Ser Leu Ile Ile Arg Ser Ile Lys Ala Thr Trp  
65 70 75 80

Ser Ser Phe Glu Met Val Ser Met Leu Ala Leu Ile Trp Leu Ile Arg  
85 90 95

Leu Ser Phe Leu Arg Ser Pro Ile Ala Ile Ala Val Ser Ser Ser Pro  
100 105 110

Val Leu Lys Pro Gly Ser Thr  
115

<210> 23

<211> 1455

<212> DNA

<213> Streptococcus pneumoniae

<400> 23

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tatgtggatg gcagccagtc aagtcagaaa agtgaaaact tgacaccaga ccaggtttagc 180  
cagaaagaag gaattcaggc tgagcaaatt gtaatcaaaa ttacagatca gggctatgta 240  
acgtcacacg gtgaccacta tcattactat aatgggaaag ttctttatga tgccctcttt 300  
agtgaagaac tcttgatgaa ggatccaaac tatcaactta aagacgctga tattgtcaat 360  
gaagtcaagg gtgggttatat catcaaggtc gatggaaaat attatgtcta cctgaaagat 420  
gcagctcatg ctgataatgt tcgaactaaa gatgaaatca atcgtcaaaa acaagaacat 480  
gtcaaagata atgagaaggt taactctaatt gttgctgtag caaggtctca gggacgatat 540

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acgacaaatg atggttatgt ctttaatcca gctgatatta tcgaagatac gggtaatgct 600
tatatcgttc ctcatggagg tcactatcac tacattccca aaagcgattt atctgctagt 660
gaattagcag cagctaaagc acatctggct ggaaaaaata tgcaaccgag tcagttaagc 720
tattcttcaa cagctagtga caataacacg caatctgtag caaaaggatc aactagcaag 780
ccagcaaata aatctgaaaa tctccagagt cttttgaagg aactctatga ttcacctagc 840
gcccaacgtt acagtgaatc agatggcctg gtctttgacc ctgctaagat tatcagtcgt 900
acaccaaatg gagttgcgat tccgcatggc gaccattacc actttattcc ttacagcaag 960
ctttctgcct tagaagaaaa gattgccaga atgggtgccta tcagtggaac tggttctaca 1020
gtttctacaa atgcaaaacc taatgaagta gtgtctagtc taggcagtct ttcaagcaat 1080
ccttcttctt taacgacaag taaggagctc tcttcagcat ctgatggtta tatttttaat 1140
ccaaaagata tcgttgaaga aacggctaca gcttatattg taagacatgg tgatcatttc 1200
cattacattc caaaatcaaa tcaaattggg caaccgactc ttccaaacaa tagtctagca 1260
acaccttctc catctcttcc aatcaatcca ggaacttcac atgagaaaca tgaagaagat 1320
ggatacggat ttgatgctaa tcgtattatc gctgaagatg aatcagggtt tgatcatgagt 1380
cacggagacc acaatcatta tttcttcaag aaggacttga cagaagagca aattaagggtg 1440
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<210> 24

<211> 484

<212> PRT

<213> Streptococcus pneumoniae

<400> 24

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Met Lys Phe Ser Lys Lys Tyr Ile Ala Ala Gly Ser Ala Val Ile Val
  1              5              10              15

Ser Leu Ser Leu Cys Ala Tyr Ala Leu Asn Gln His Arg Ser Gln Glu
      20              25              30

Asn Lys Asp Asn Asn Arg Val Ser Tyr Val Asp Gly Ser Gln Ser Ser
      35              40              45

Gln Lys Ser Glu Asn Leu Thr Pro Asp Gln Val Ser Gln Lys Glu Gly
      50              55              60

Ile Gln Ala Glu Gln Ile Val Ile Lys Ile Thr Asp Gln Gly Tyr Val
      65              70              75              80

Thr Ser His Gly Asp His Tyr His Tyr Tyr Asn Gly Lys Val Pro Tyr
      85              90              95

Asp Ala Leu Phe Ser Glu Glu Leu Leu Met Lys Asp Pro Asn Tyr Gln
      100             105             110

Leu Lys Asp Ala Asp Ile Val Asn Glu Val Lys Gly Gly Tyr Ile Ile
      115             120             125

Lys Val Asp Gly Lys Tyr Tyr Val Tyr Leu Lys Asp Ala Ala His Ala
      130             135             140

Asp Asn Val Arg Thr Lys Asp Glu Ile Asn Arg Gln Lys Gln Glu His
      145             150             155             160

Val Lys Asp Asn Glu Lys Val Asn Ser Asn Val Ala Val Ala Arg Ser
      165             170             175

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Gln | Gly | Arg | Tyr | Thr | Thr | Asn | Asp | Gly | Tyr | Val | Phe | Asn | Pro | Ala | Asp |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |
| Ile | Ile | Glu | Asp | Thr | Gly | Asn | Ala | Tyr | Ile | Val | Pro | His | Gly | Gly | His |  |
|     |     | 195 |     |     |     | 200 |     |     |     |     | 205 |     |     |     |     |  |
| Tyr | His | Tyr | Ile | Pro | Lys | Ser | Asp | Leu | Ser | Ala | Ser | Glu | Leu | Ala | Ala |  |
|     | 210 |     |     |     |     | 215 |     |     |     | 220 |     |     |     |     |     |  |
| Ala | Lys | Ala | His | Leu | Ala | Gly | Lys | Asn | Met | Gln | Pro | Ser | Gln | Leu | Ser |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |
| Tyr | Ser | Ser | Thr | Ala | Ser | Asp | Asn | Asn | Thr | Gln | Ser | Val | Ala | Lys | Gly |  |
|     |     |     | 245 |     |     |     |     |     | 250 |     |     |     |     | 255 |     |  |
| Ser | Thr | Ser | Lys | Pro | Ala | Asn | Lys | Ser | Glu | Asn | Leu | Gln | Ser | Leu | Leu |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |
| Lys | Glu | Leu | Tyr | Asp | Ser | Pro | Ser | Ala | Gln | Arg | Tyr | Ser | Glu | Ser | Asp |  |
|     | 275 |     |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |
| Gly | Leu | Val | Phe | Asp | Pro | Ala | Lys | Ile | Ile | Ser | Arg | Thr | Pro | Asn | Gly |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |
| Val | Ala | Ile | Pro | His | Gly | Asp | His | Tyr | His | Phe | Ile | Pro | Tyr | Ser | Lys |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |
| Leu | Ser | Ala | Leu | Glu | Glu | Lys | Ile | Ala | Arg | Met | Val | Pro | Ile | Ser | Gly |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |  |
| Thr | Gly | Ser | Thr | Val | Ser | Thr | Asn | Ala | Lys | Pro | Asn | Glu | Val | Val | Ser |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |
| Ser | Leu | Gly | Ser | Leu | Ser | Ser | Asn | Pro | Ser | Ser | Leu | Thr | Thr | Ser | Lys |  |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |  |
| Glu | Leu | Ser | Ser | Ala | Ser | Asp | Gly | Tyr | Ile | Phe | Asn | Pro | Lys | Asp | Ile |  |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |  |
| Val | Glu | Glu | Thr | Ala | Thr | Ala | Tyr | Ile | Val | Arg | His | Gly | Asp | His | Phe |  |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |  |
| His | Tyr | Ile | Pro | Lys | Ser | Asn | Gln | Ile | Gly | Gln | Pro | Thr | Leu | Pro | Asn |  |
|     |     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |  |
| Asn | Ser | Leu | Ala | Thr | Pro | Ser | Pro | Ser | Leu | Pro | Ile | Asn | Pro | Gly | Thr |  |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |     |  |
| Ser | His | Glu | Lys | His | Glu | Glu | Asp | Gly | Tyr | Gly | Phe | Asp | Ala | Asn | Arg |  |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |  |
| Ile | Ile | Ala | Glu | Asp | Glu | Ser | Gly | Phe | Val | Met | Ser | His | Gly | Asp | His |  |
|     | 450 |     |     |     |     | 455 |     |     |     |     | 460 |     |     |     |     |  |
| Asn | His | Tyr | Phe | Phe | Lys | Lys | Asp | Leu | Thr | Glu | Glu | Gln | Ile | Lys | Val |  |
| 465 |     |     |     |     | 470 |     |     |     |     | 475 |     |     |     |     | 480 |  |

Arg Lys Asn Ile

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<211> 840

<212> DNA

<213> Streptococcus pneumoniae

<400> 25

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<211> 279

<212> PRT

<213> Streptococcus pneumoniae

<400> 26

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Gly Ser Tyr Thr Ala Leu Ile Gly His Thr Gly Ser Gly Lys Ser Thr
      35                      40                      45

Ile Leu Gln Leu Leu Asn Gly Leu Leu Val Pro Ser Gln Gly Ser Val
      50                      55                      60

Arg Val Phe Asp Thr Leu Ile Thr Ser Thr Ser Lys Asn Lys Asp Ile
      65                      70                      75                      80

Arg Gln Ile Arg Lys Gln Val Gly Leu Val Phe Gln Phe Ala Glu Asn
      85                      90                      95

Gln Ile Phe Glu Glu Thr Val Leu Lys Asp Val Ala Phe Gly Pro Gln
      100                     105                     110

Asn Phe Gly Val Ser Glu Glu Asp Ala Val Lys Thr Ala Arg Glu Lys
      115                     120                     125
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<211> 2119

<212> PRT

<213> Streptococcus pneumoniae

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Ile His Ser Ala Met Glu Thr Ser Gln Asp Phe Lys Glu Lys Lys Thr
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Ala Val Ile Lys Glu Lys Glu Val Val Ser Lys Asn Pro Val Ile Asp
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Asn Asn Thr Ser Asn Glu Glu Ala Lys Ile Lys Glu Glu Asn Ser Asn
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Lys Ser Gln Gly Asp Tyr Thr Asp Ser Phe Val Asn Lys Asn Thr Glu
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Asn Pro Lys Lys Glu Asp Lys Val Val Tyr Ile Ala Glu Phe Lys Asp

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| 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |     |     |     |
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| Lys | Glu | Ser | Gly | Glu | Lys | Ala | Ile | Lys | Glu | Leu | Ser | Ser | Leu | Lys | Asn |
|     | 115 |     |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Thr | Lys | Val | Leu | Tyr | Thr | Tyr | Asp | Arg | Ile | Phe | Asn | Gly | Ser | Ala | Ile |
|     | 130 |     |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |
| Glu | Thr | Thr | Pro | Asp | Asn | Leu | Asp | Lys | Ile | Lys | Gln | Ile | Glu | Gly | Ile |
| 145 |     |     |     |     |     |     | 150 |     |     |     |     | 155 |     |     | 160 |
| Ser | Ser | Val | Glu | Arg | Ala | Gln | Lys | Val | Gln | Pro | Met | Met | Asn | His | Ala |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |
| Arg | Lys | Glu | Ile | Gly | Val | Glu | Glu | Ala | Ile | Asp | Tyr | Leu | Lys | Ser | Ile |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Asn | Ala | Pro | Phe | Gly | Lys | Asn | Phe | Asp | Gly | Arg | Gly | Met | Val | Ile | Ser |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| Asn | Ile | Asp | Thr | Gly | Thr | Asp | Tyr | Arg | His | Lys | Ala | Met | Arg | Ile | Asp |
|     | 210 |     |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |
| Asp | Asp | Ala | Lys | Ala | Ser | Met | Arg | Phe | Lys | Lys | Glu | Asp | Leu | Lys | Gly |
| 225 |     |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     | 240 |
| Thr | Asp | Lys | Asn | Tyr | Trp | Leu | Ser | Asp | Lys | Ile | Pro | His | Ala | Phe | Asn |
|     |     |     | 245 |     |     |     |     |     | 250 |     |     |     |     | 255 |     |
| Tyr | Tyr | Asn | Gly | Gly | Lys | Ile | Thr | Val | Glu | Lys | Tyr | Asp | Asp | Gly | Arg |
|     |     | 260 |     |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| Asp | Tyr | Phe | Asp | Pro | His | Gly | Met | His | Ile | Ala | Gly | Ile | Leu | Ala | Gly |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |
| Asn | Asp | Thr | Glu | Gln | Asp | Ile | Lys | Asn | Phe | Asn | Gly | Ile | Asp | Gly | Ile |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |
| Ala | Pro | Asn | Ala | Gln | Ile | Phe | Ser | Tyr | Lys | Met | Tyr | Ser | Asp | Ala | Gly |
| 305 |     |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     | 320 |
| Ser | Gly | Phe | Ala | Gly | Asp | Glu | Thr | Met | Phe | His | Ala | Ile | Glu | Asp | Ser |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |
| Ile | Lys | His | Asn | Val | Asp | Val | Val | Ser | Val | Ser | Ser | Gly | Phe | Thr | Gly |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |
| Thr | Gly | Leu | Val | Gly | Glu | Lys | Tyr | Trp | Gln | Ala | Ile | Arg | Ala | Leu | Arg |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |
| Lys | Ala | Gly | Ile | Pro | Met | Val | Val | Ala | Thr | Gly | Asn | Tyr | Ala | Thr | Ser |
|     | 370 |     |     |     |     |     | 375 |     |     |     | 380 |     |     |     |     |
| Ala | Ser | Ser | Ser | Ser | Trp | Asp | Leu | Val | Ala | Asn | Asn | His | Leu | Lys | Met |
| 385 |     |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     | 400 |
| Thr | Asp | Thr | Gly | Asn | Val | Thr | Arg | Thr | Ala | Ala | His | Glu | Asp | Ala | Ile |

| 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ala | Val | Ala | Ser | Ala | Lys | Asn | Gln | Thr | Val | Glu | Phe | Asp | Lys | Val | Asn |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |     |
| Ile | Gly | Gly | Glu | Ser | Phe | Lys | Tyr | Arg | Asn | Ile | Gly | Ala | Phe | Phe | Asp |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |
| Lys | Ser | Lys | Ile | Thr | Thr | Asn | Glu | Asp | Gly | Thr | Lys | Ala | Pro | Ser | Lys |
|     |     | 450 |     |     |     |     | 455 |     |     |     |     | 460 |     |     |     |
| Leu | Lys | Phe | Val | Tyr | Ile | Gly | Lys | Gly | Gln | Asp | Gln | Asp | Leu | Ile | Gly |
| 465 |     |     |     |     |     | 470 |     |     |     |     | 475 |     |     |     | 480 |
| Leu | Asp | Leu | Arg | Gly | Lys | Ile | Ala | Val | Met | Asp | Arg | Ile | Tyr | Thr | Lys |
|     |     |     |     | 485 |     |     |     |     | 490 |     |     |     |     | 495 |     |
| Asp | Leu | Lys | Asn | Ala | Phe | Lys | Lys | Ala | Met | Asp | Lys | Gly | Ala | Arg | Ala |
|     |     |     | 500 |     |     |     |     | 505 |     |     |     |     | 510 |     |     |
| Ile | Met | Val | Val | Asn | Thr | Val | Asn | Tyr | Tyr | Asn | Arg | Asp | Asn | Trp | Thr |
|     |     | 515 |     |     |     |     | 520 |     |     |     |     | 525 |     |     |     |
| Glu | Leu | Pro | Ala | Met | Gly | Tyr | Glu | Ala | Asp | Glu | Gly | Thr | Lys | Ser | Gln |
|     |     | 530 |     |     |     |     | 535 |     |     |     |     | 540 |     |     |     |
| Val | Phe | Ser | Ile | Ser | Gly | Asp | Asp | Gly | Val | Lys | Leu | Trp | Asn | Met | Ile |
| 545 |     |     |     |     |     | 550 |     |     |     |     | 555 |     |     |     | 560 |
| Asn | Pro | Asp | Lys | Lys | Thr | Glu | Val | Lys | Arg | Asn | Asn | Lys | Glu | Asp | Phe |
|     |     |     |     | 565 |     |     |     |     | 570 |     |     |     |     | 575 |     |
| Lys | Asp | Lys | Leu | Glu | Gln | Tyr | Tyr | Pro | Ile | Asp | Met | Glu | Ser | Phe | Asn |
|     |     |     | 580 |     |     |     |     | 585 |     |     |     |     | 590 |     |     |
| Ser | Asn | Lys | Pro | Asn | Val | Gly | Asp | Glu | Lys | Glu | Ile | Asp | Phe | Lys | Phe |
|     |     | 595 |     |     |     |     | 600 |     |     |     |     | 605 |     |     |     |
| Ala | Pro | Asp | Thr | Asp | Lys | Glu | Leu | Tyr | Lys | Glu | Asp | Ile | Ile | Val | Pro |
|     |     | 610 |     |     |     |     | 615 |     |     |     |     | 620 |     |     |     |
| Ala | Gly | Ser | Thr | Ser | Trp | Gly | Pro | Arg | Ile | Asp | Leu | Leu | Leu | Lys | Pro |
| 625 |     |     |     |     |     | 630 |     |     |     |     | 635 |     |     |     | 640 |
| Asp | Val | Ser | Ala | Pro | Gly | Lys | Asn | Ile | Lys | Ser | Thr | Leu | Asn | Val | Ile |
|     |     |     |     | 645 |     |     |     |     | 650 |     |     |     |     | 655 |     |
| Asn | Gly | Lys | Ser | Thr | Tyr | Gly | Tyr | Met | Ser | Gly | Thr | Ser | Met | Ala | Thr |
|     |     |     | 660 |     |     |     |     | 665 |     |     |     |     | 670 |     |     |
| Pro | Ile | Val | Ala | Ala | Ser | Thr | Val | Leu | Ile | Arg | Pro | Lys | Leu | Lys | Glu |
|     |     | 675 |     |     |     |     | 680 |     |     |     |     | 685 |     |     |     |
| Met | Leu | Glu | Arg | Pro | Val | Leu | Lys | Asn | Leu | Lys | Gly | Asp | Asp | Lys | Ile |
|     |     | 690 |     |     |     |     | 695 |     |     |     |     | 700 |     |     |     |
| Asp | Leu | Thr | Ser | Leu | Thr | Lys | Ile | Ala | Leu | Gln | Asn | Thr | Ala | Arg | Pro |

|   |  |     |  |      |  |      |
|---|--|-----|--|------|--|------|
| 705   |  | 710 |  | 715  |  | 720  |
| Met Met Asp Ala Thr Ser Trp Lys Glu Lys Ser Gln Tyr Phe Ala Ser |  |     |  |      |  |      |
|   |  | 725 |  | 730  |  | 735  |
| Pro Arg Gln Gln Gly Ala Gly Leu Ile Asn Val Ala Asn Ala Leu Arg |  |     |  |      |  |      |
|   |  | 740 |  | 745  |  | 750  |
| Asn Glu Val Val Ala Thr Phe Lys Asn Thr Asp Ser Lys Gly Leu Val |  |     |  |      |  |      |
|   |  | 755 |  | 760  |  | 765  |
| Asn Ser Tyr Gly Ser Ile Ser Leu Lys Glu Ile Lys Gly Asp Lys Lys |  |     |  |      |  |      |
|   |  | 770 |  | 775  |  | 780  |
| Tyr Phe Thr Ile Lys Leu His Asn Thr Ser Asn Arg Pro Leu Thr Phe |  |     |  |      |  |      |
|   |  | 785 |  | 790  |  | 795  |
|   |  |     |  |      |  | 800  |
| Lys Val Ser Ala Ser Ala Ile Thr Thr Asp Ser Leu Thr Asp Arg Leu |  |     |  |      |  |      |
|   |  | 805 |  | 810  |  | 815  |
| Lys Leu Asp Glu Thr Tyr Lys Asp Glu Lys Ser Pro Asp Gly Lys Gln |  |     |  |      |  |      |
|   |  | 820 |  | 825  |  | 830  |
| Ile Val Pro Glu Ile His Pro Glu Lys Val Lys Gly Ala Asn Ile Thr |  |     |  |      |  |      |
|   |  | 835 |  | 840  |  | 845  |
| Phe Glu His Asp Thr Phe Thr Ile Gly Ala Asn Ser Ser Phe Asp Leu |  |     |  |      |  |      |
|   |  | 850 |  | 855  |  | 860  |
| Asn Ala Val Ile Asn Val Gly Glu Ala Lys Asn Lys Asn Lys Phe Val |  |     |  |      |  |      |
|   |  | 865 |  | 870  |  | 875  |
|   |  |     |  |      |  | 880  |
| Glu Ser Phe Ile His Phe Glu Ser Val Glu Ala Met Glu Ala Leu Asn |  |     |  |      |  |      |
|   |  | 885 |  | 890  |  | 895  |
| Ser Ser Gly Lys Lys Ile Asn Phe Gln Pro Ser Leu Ser Met Pro Leu |  |     |  |      |  |      |
|   |  | 900 |  | 905  |  | 910  |
| Met Gly Phe Ala Gly Asn Trp Asn His Glu Pro Ile Leu Asp Lys Trp |  |     |  |      |  |      |
|   |  | 915 |  | 920  |  | 925  |
| Ala Trp Glu Glu Gly Ser Arg Ser Lys Thr Leu Gly Gly Tyr Asp Asp |  |     |  |      |  |      |
|   |  | 930 |  | 935  |  | 940  |
| Asp Gly Lys Pro Lys Ile Pro Gly Thr Leu Asn Lys Gly Ile Gly Gly |  |     |  |      |  |      |
|   |  | 945 |  | 950  |  | 955  |
|   |  |     |  |      |  | 960  |
| Glu His Gly Ile Asp Lys Phe Asn Pro Ala Gly Val Ile Gln Asn Arg |  |     |  |      |  |      |
|   |  | 965 |  | 970  |  | 975  |
| Lys Asp Lys Asn Thr Thr Ser Leu Asp Gln Asn Pro Glu Leu Phe Ala |  |     |  |      |  |      |
|   |  | 980 |  | 985  |  | 990  |
| Phe Asn Asn Glu Gly Ile Asn Ala Pro Ser Ser Ser Gly Ser Lys Ile |  |     |  |      |  |      |
|   |  | 995 |  | 1000 |  | 1005 |
| Ala Asn Ile Tyr Pro Leu Asp Ser Asn Gly Asn Pro Gln Asp Ala Gln |  |     |  |      |  |      |

| 1010  | 1015 | 1020 |
|---|------|------|
| Leu Glu Arg Gly Leu Thr Pro Ser Pro Leu Val Leu Arg Ser Ala Glu<br>1025                      1030                      1035                      1040 |      |      |
| Glu Gly Leu Ile Ser Ile Val Asn Thr Asn Lys Glu Gly Glu Asn Gln<br>1045                      1050                      1055                           |      |      |
| Arg Asp Leu Lys Val Ile Ser Arg Glu His Phe Ile Arg Gly Ile Leu<br>1060                      1065                      1070                           |      |      |
| Asn Ser Lys Ser Asn Asp Ala Lys Gly Ile Lys Ser Ser Lys Leu Lys<br>1075                      1080                      1085                           |      |      |
| Val Trp Gly Asp Leu Lys Trp Asp Gly Leu Ile Tyr Asn Pro Arg Gly<br>1090                      1095                      1100                           |      |      |
| Arg Glu Glu Asn Ala Pro Glu Ser Lys Asp Asn Gln Asp Pro Ala Thr<br>1105                      1110                      1115                      1120 |      |      |
| Lys Ile Arg Gly Gln Phe Glu Pro Ile Ala Glu Gly Gln Tyr Phe Tyr<br>1125                      1130                      1135                           |      |      |
| Lys Phe Lys Tyr Arg Leu Thr Lys Asp Tyr Pro Trp Gln Val Ser Tyr<br>1140                      1145                      1150                           |      |      |
| Ile Pro Val Lys Ile Asp Asn Thr Ala Pro Lys Ile Val Ser Val Asp<br>1155                      1160                      1165                           |      |      |
| Phe Ser Asn Pro Glu Lys Ile Lys Leu Ile Thr Lys Asp Thr Tyr His<br>1170                      1175                      1180                           |      |      |
| Lys Val Lys Asp Gln Tyr Lys Asn Glu Thr Leu Phe Ala Arg Asp Gln<br>1185                      1190                      1195                      1200 |      |      |
| Lys Glu His Pro Glu Lys Phe Asp Glu Ile Ala Asn Glu Val Trp Tyr<br>1205                      1210                      1215                           |      |      |
| Ala Gly Ala Ala Leu Val Asn Glu Asp Gly Glu Val Glu Lys Asn Leu<br>1220                      1225                      1230                           |      |      |
| Glu Val Thr Tyr Ala Gly Glu Gly Gln Gly Arg Asn Arg Lys Leu Asp<br>1235                      1240                      1245                           |      |      |
| Lys Asp Gly Asn Thr Ile Tyr Glu Ile Lys Gly Ala Gly Asp Leu Arg<br>1250                      1255                      1260                           |      |      |
| Gly Lys Ile Ile Glu Val Ile Ala Leu Asp Gly Ser Ser Asn Phe Thr<br>1265                      1270                      1275                      1280 |      |      |
| Lys Ile His Arg Ile Lys Phe Ala Asn Gln Ala Asp Glu Lys Gly Met<br>1285                      1290                      1295                           |      |      |
| Ile Ser Tyr Tyr Leu Val Asp Pro Asp Gln Asp Ser Ser Lys Tyr Gln<br>1300                      1305                      1310                           |      |      |
| Lys Leu Gly Glu Ile Ala Glu Ser Lys Phe Lys Asn Leu Gly Asn Gly   |      |      |

| 1315   | 1320 | 1325 |
|--|------|------|
| Lys Glu Gly Ser Leu Lys Lys Asp Thr Thr Gly Val Glu His His His<br>1330 1335 1340      |      |      |
| Gln Glu Asn Glu Glu Ser Ile Lys Glu Lys Ser Ser Phe Thr Ile Asp<br>1345 1350 1355 1360 |      |      |
| Arg Asn Ile Ser Thr Ile Arg Asp Phe Glu Asn Lys Asp Leu Lys Lys<br>1365 1370 1375      |      |      |
| Leu Ile Lys Lys Lys Phe Arg Glu Val Asp Asp Phe Thr Ser Glu Thr<br>1380 1385 1390      |      |      |
| Gly Lys Arg Met Glu Glu Tyr Asp Tyr Lys Tyr Asp Asp Lys Gly Asn<br>1395 1400 1405      |      |      |
| Ile Ile Ala Tyr Asp Asp Gly Thr Asp Leu Glu Tyr Glu Thr Glu Lys<br>1410 1415 1420      |      |      |
| Leu Asp Glu Ile Lys Ser Lys Ile Tyr Gly Val Leu Ser Pro Ser Lys<br>1425 1430 1435 1440 |      |      |
| Asp Gly His Phe Glu Ile Leu Gly Lys Ile Ser Asn Val Ser Lys Asn<br>1445 1450 1455      |      |      |
| Ala Lys Val Tyr Tyr Gly Asn Asn Tyr Lys Ser Ile Glu Ile Lys Ala<br>1460 1465 1470      |      |      |
| Thr Lys Tyr Asp Phe His Ser Lys Thr Met Thr Phe Asp Leu Tyr Ala<br>1475 1480 1485      |      |      |
| Asn Ile Asn Asp Ile Val Asp Gly Leu Ala Phe Ala Gly Asp Met Arg<br>1490 1495 1500      |      |      |
| Leu Phe Val Lys Asp Asn Asp Gln Lys Lys Ala Glu Ile Lys Ile Arg<br>1505 1510 1515 1520 |      |      |
| Met Pro Glu Lys Ile Lys Glu Thr Lys Ser Glu Tyr Pro Tyr Val Ser<br>1525 1530 1535      |      |      |
| Ser Tyr Gly Asn Val Ile Glu Leu Gly Glu Gly Asp Leu Ser Lys Asn<br>1540 1545 1550      |      |      |
| Lys Pro Asp Asn Leu Thr Lys Met Glu Ser Gly Lys Ile Tyr Ser Asp<br>1555 1560 1565      |      |      |
| Ser Glu Lys Gln Gln Tyr Leu Leu Lys Asp Asn Ile Ile Leu Arg Lys<br>1570 1575 1580      |      |      |
| Gly Tyr Ala Leu Lys Val Thr Thr Tyr Asn Pro Gly Lys Thr Asp Met<br>1585 1590 1595 1600 |      |      |
| Leu Glu Gly Asn Gly Val Tyr Ser Lys Glu Asp Ile Ala Lys Ile Gln<br>1605 1610 1615      |      |      |
| Lys Ala Asn Pro Asn Leu Arg Ala Leu Ser Glu Thr Thr Ile Tyr Ala                        |      |      |

|   |      |      |
|---|------|------|
| 1620  | 1625 | 1630 |
| Asp Ser Arg Asn Val Glu Asp Gly Arg Ser Thr Gln Ser Val Leu Met |      |      |
| 1635  | 1640 | 1645 |
| Ser Ala Leu Asp Gly Phe Asn Ile Ile Arg Tyr Gln Val Phe Thr Phe |      |      |
| 1650  | 1655 | 1660 |
| Lys Met Asn Asp Lys Gly Glu Ala Ile Asp Lys Asp Gly Asn Leu Val |      |      |
| 1665  | 1670 | 1675 |
| Thr Asp Ser Ser Lys Leu Val Leu Phe Gly Lys Asp Asp Lys Glu Tyr |      |      |
| 1685  | 1690 | 1695 |
| Thr Gly Glu Asp Lys Phe Asn Val Glu Ala Ile Lys Glu Asp Gly Ser |      |      |
| 1700  | 1705 | 1710 |
| Met Leu Phe Ile Asp Thr Lys Pro Val Asn Leu Ser Met Asp Lys Asn |      |      |
| 1715  | 1720 | 1725 |
| Tyr Phe Asn Pro Ser Lys Ser Asn Lys Ile Tyr Val Arg Asn Pro Glu |      |      |
| 1730  | 1735 | 1740 |
| Phe Tyr Leu Arg Gly Lys Ile Ser Asp Lys Gly Gly Phe Asn Trp Glu |      |      |
| 1745  | 1750 | 1755 |
| Leu Arg Val Asn Glu Ser Val Val Asp Asn Tyr Leu Ile Tyr Gly Asp |      |      |
| 1765  | 1770 | 1775 |
| Leu His Ile Asp Asn Thr Arg Asp Phe Asn Ile Lys Leu Asn Val Lys |      |      |
| 1780  | 1785 | 1790 |
| Asp Gly Asp Ile Met Asp Trp Gly Met Lys Asp Tyr Lys Ala Asn Gly |      |      |
| 1795  | 1800 | 1805 |
| Phe Pro Asp Lys Val Thr Asp Met Asp Gly Asn Val Tyr Leu Gln Thr |      |      |
| 1810  | 1815 | 1820 |
| Gly Tyr Ser Asp Leu Asn Ala Lys Ala Val Gly Val His Tyr Gln Phe |      |      |
| 1825  | 1830 | 1835 |
| Leu Tyr Asp Asn Val Lys Pro Glu Val Asn Ile Asp Pro Lys Gly Asn |      |      |
| 1845  | 1850 | 1855 |
| Thr Ser Ile Glu Tyr Ala Asp Gly Lys Ser Val Val Phe Asn Ile Asn |      |      |
| 1860  | 1865 | 1870 |
| Asp Lys Arg Asn Asn Gly Phe Asp Gly Glu Ile Gln Glu Gln His Ile |      |      |
| 1875  | 1880 | 1885 |
| Tyr Ile Asn Gly Lys Glu Tyr Thr Ser Phe Asn Asp Ile Lys Gln Ile |      |      |
| 1890  | 1895 | 1900 |
| Ile Asp Lys Thr Leu Asn Ile Lys Ile Val Val Lys Asp Phe Ala Arg |      |      |
| 1905  | 1910 | 1915 |
| Asn Thr Thr Val Lys Glu Phe Ile Leu Asn Lys Asp Thr Gly Glu Val |      |      |

|   |      |      |
|---|------|------|
| 1925  | 1930 | 1935 |
| Ser Glu Leu Lys Pro His Arg Val Thr Val Thr Ile Gln Asn Gly Lys |      |      |
| 1940  | 1945 | 1950 |
| Glu Met Ser Ser Thr Ile Val Ser Glu Glu Asp Phe Ile Leu Pro Val |      |      |
| 1955  | 1960 | 1965 |
| Tyr Lys Gly Glu Leu Glu Lys Gly Tyr Gln Phe Asp Gly Trp Glu Ile |      |      |
| 1970  | 1975 | 1980 |
| Ser Gly Phe Glu Gly Lys Lys Asp Ala Gly Tyr Val Ile Asn Leu Ser |      |      |
| 1985  | 1990 | 1995 |
| Lys Asp Thr Phe Ile Lys Pro Val Phe Lys Lys Ile Glu Glu Lys Lys |      |      |
| 2005  | 2010 | 2015 |
| Glu Glu Glu Asn Lys Pro Thr Phe Asp Val Ser Lys Lys Lys Asp Asn |      |      |
| 2020  | 2025 | 2030 |
| Pro Gln Val Asn His Ser Gln Leu Asn Glu Ser His Arg Lys Glu Asp |      |      |
| 2035  | 2040 | 2045 |
| Leu Gln Arg Glu Glu His Ser Gln Lys Ser Asp Ser Thr Lys Asp Val |      |      |
| 2050  | 2055 | 2060 |
| Thr Ala Thr Val Leu Asp Lys Asn Asn Ile Ser Ser Lys Ser Thr Thr |      |      |
| 2065  | 2070 | 2075 |
| Asn Asn Pro Asn Lys Leu Pro Lys Thr Gly Thr Ala Ser Gly Ala Gln |      |      |
| 2085  | 2090 | 2095 |
| Thr Leu Leu Ala Ala Gly Ile Met Phe Ile Val Gly Ile Phe Leu Gly |      |      |
| 2100  | 2105 | 2110 |
| Leu Lys Lys Lys Asn Gln Asp                                     |      |      |
| 2115  |      |      |

<210> 29  
 <211> 597  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 29  
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 aaagatgtgc gtacggctat cgaaattgca accttagcgc caagcgccca caacagccag 120  
 ccttggaat ttgtggtggt acgtgagaaa aatgctgaac tggcaaagt agcttatggt 180  
 tccaattttg aacaggtatc atcagcgcct gtaaccattg ccttgtttac agatacggac 240  
 ttagccaaac gtgctcgtaa gattgcccggt gttggtggtg ctaataactt ttctgaagag 300  
 caacttcaat attttatgaa aaatctgcca gctgagtttg cccgttacag tgagcaacaa 360  
 gtcagcgact acctagctct caatgcaggt ttggttgcca tgaacttggt tcttgcatg 420  
 acagaccaag gaattggttc taacattatt cttggttttg acaaatacaa agttaatgaa 480  
 gttttgaaa tgaagaccg tttccgcca gaactcttga tcacagtggg ttatacagac 540  
 gaaaaattgg aaccaagcta ccgcttgcca gtagatgaaa tcatcgagaa aagatag 597



<210> 30  
 <211> 198  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 30  
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     1                    5                    10                    15  
 Leu Val Asp Pro Lys Asp Val Arg Thr Ala Ile Glu Ile Ala Thr Leu  
                     20                    25                    30  
 Ala Pro Ser Ala His Asn Ser Gln Pro Trp Lys Phe Val Val Val Arg  
                     35                    40                    45  
 Glu Lys Asn Ala Glu Leu Ala Lys Leu Ala Tyr Gly Ser Asn Phe Glu  
     50                    55                    60  
 Gln Val Ser Ser Ala Pro Val Thr Ile Ala Leu Phe Thr Asp Thr Asp  
     65                    70                    75                    80  
 Leu Ala Lys Arg Ala Arg Lys Ile Ala Arg Val Gly Gly Ala Asn Asn  
                     85                    90                    95  
 Phe Ser Glu Glu Gln Leu Gln Tyr Phe Met Lys Asn Leu Pro Ala Glu  
                     100                    105                    110  
 Phe Ala Arg Tyr Ser Glu Gln Gln Val Ser Asp Tyr Leu Ala Leu Asn  
                     115                    120                    125  
 Ala Gly Leu Val Ala Met Asn Leu Val Leu Ala Leu Thr Asp Gln Gly  
     130                    135                    140  
 Ile Gly Ser Asn Ile Ile Leu Gly Phe Asp Lys Ser Lys Val Asn Glu  
     145                    150                    155                    160  
 Val Leu Glu Ile Glu Asp Arg Phe Arg Pro Glu Leu Leu Ile Thr Val  
                     165                    170                    175  
 Gly Tyr Thr Asp Glu Lys Leu Glu Pro Ser Tyr Arg Leu Pro Val Asp  
                     180                    185                    190  
 Glu Ile Ile Glu Lys Arg  
     195

<210> 31  
 <211> 1401  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 31  
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 ttgtttagcc ttttgaaat caattcagaa cgtgatgaca gcaaggctga tgcccagcat 120  
 ccatttgggc ctggtccagt aaaagccttg gagaaattcc ttgaaatcgc agaccgcgat 180

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ggctacccaa ctaagaatgt tgataactat gcaggacatt ttgagtttgg tgatggagaa 240
gaagttctcg gaatctttgc ccatatggat gtggtgcctg ctggtagcgg ttgggacaca 300
gacccttaca caccaactat caaagatggt cgcctttatg cgcgcggggc ttcggacgat 360
aagggtccta caacagcttg ttactatggt ttgaaaatca tcaaagaatt gggctctcca 420
acttctaaga aagttcgctt catcgttgga acagacgaag aatcaggctg ggcagacatg 480
gactactact ttgagcacgt aggacttgcc aaaccagatt tcggtttctc accagatgct 540
gaatttccaa tcatcaatgg tgaaaaagga aatatcacgg aatacctcca ctttgcagga 600
gaaaatacag gtgttgcccg tcttcacagc tttacagggt gtttacgtga aaatatggta 660
ccagaatcag caacagcagt cgtttcagggt gacttggtg acttgcaagc taaactagat 720
gcctttgttg cagaacacaa acttagagga gaactccaag aagaagctgg caaatacaag 780
gtgacgatca ttggtaaatc agcccacggt gctatgcctg cttcagggtg caatggcgca 840
acttaccttg cctcttctct cagccagttt ggctttgctg gtccagccaa agactacctt 900
gacatcgtag gtaaaattct cttgaacgat catgagggtg aaaatcttaa gattgctcat 960
gtggatgaaa agatgggtgc tctttctatg aatgcccggc tcttcactt cgatgaaaca 1020
agtgtgata ataccattgc cctcaacatc cgctatccaa aaggaacaag tccagaacaa 1080
atcaagtcaa tccttgaaaa cttgccagtt gtttctgtta gcctgtctga acacggtcac 1140
acgcctcact atgtgccaat ggaagatcca cttgtgcaaa ccttgttgaa tatctatgaa 1200
aaacaaactg gctttaaagg tcatgaacaa gtcacgggtg gtggaacctt tggtcgcttg 1260
ctagaacgag gagttgccta cgggtgctat ttcccagact cgattgatac catgcaccaa 1320
gccaatgaat ttatcgctt ggatgatctt ttccgagcag cagcaattta tgccgaagct 1380
atttacgaat tgatcaata a                                     1401

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<210> 32

<211> 466

<212> PRT

<213> Streptococcus pneumoniae

<400> 32

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Met Thr Ala Ile Asp Phe Thr Ala Glu Val Glu Lys Arg Lys Glu Asp
  1              5              10              15

```

```

Leu Leu Ala Asp Leu Phe Ser Leu Leu Glu Ile Asn Ser Glu Arg Asp
      20              25              30

```

```

Asp Ser Lys Ala Asp Ala Gln His Pro Phe Gly Pro Gly Pro Val Lys
      35              40              45

```

```

Ala Leu Glu Lys Phe Leu Glu Ile Ala Asp Arg Asp Gly Tyr Pro Thr
      50              55              60

```

```

Lys Asn Val Asp Asn Tyr Ala Gly His Phe Glu Phe Gly Asp Gly Glu
      65              70              75              80

```

```

Glu Val Leu Gly Ile Phe Ala His Met Asp Val Val Pro Ala Gly Ser
      85              90              95

```

```

Gly Trp Asp Thr Asp Pro Tyr Thr Pro Thr Ile Lys Asp Gly Arg Leu
      100             105             110

```

```

Tyr Ala Arg Gly Ala Ser Asp Asp Lys Gly Pro Thr Thr Ala Cys Tyr
      115             120             125

```

```

Tyr Gly Leu Lys Ile Ile Lys Glu Leu Gly Leu Pro Thr Ser Lys Lys
      130             135             140

```

```

Val Arg Phe Ile Val Gly Thr Asp Glu Glu Ser Gly Trp Ala Asp Met

```

|   |     |     |     |     |  |     |
|---|-----|-----|-----|-----|--|-----|
| 145   |     | 150 |     | 155 |  | 160 |
| Asp Tyr Tyr Phe Glu His Val Gly Leu Ala Lys Pro Asp Phe Gly Phe | 165 | 170 | 175 |     |  |     |
| Ser Pro Asp Ala Glu Phe Pro Ile Ile Asn Gly Glu Lys Gly Asn Ile | 180 | 185 | 190 |     |  |     |
| Thr Glu Tyr Leu His Phe Ala Gly Glu Asn Thr Gly Val Ala Arg Leu | 195 | 200 | 205 |     |  |     |
| His Ser Phe Thr Gly Gly Leu Arg Glu Asn Met Val Pro Glu Ser Ala | 210 | 215 | 220 |     |  |     |
| Thr Ala Val Val Ser Gly Asp Leu Ala Asp Leu Gln Ala Lys Leu Asp | 225 | 230 | 235 |     |  | 240 |
| Ala Phe Val Ala Glu His Lys Leu Arg Gly Glu Leu Gln Glu Glu Ala | 245 | 250 | 255 |     |  |     |
| Gly Lys Tyr Lys Val Thr Ile Ile Gly Lys Ser Ala His Gly Ala Met | 260 | 265 | 270 |     |  |     |
| Pro Ala Ser Gly Val Asn Gly Ala Thr Tyr Leu Ala Leu Phe Leu Ser | 275 | 280 | 285 |     |  |     |
| Gln Phe Gly Phe Ala Gly Pro Ala Lys Asp Tyr Leu Asp Ile Ala Gly | 290 | 295 | 300 |     |  |     |
| Lys Ile Leu Leu Asn Asp His Glu Gly Glu Asn Leu Lys Ile Ala His | 305 | 310 | 315 |     |  | 320 |
| Val Asp Glu Lys Met Gly Ala Leu Ser Met Asn Ala Gly Val Phe His | 325 | 330 | 335 |     |  |     |
| Phe Asp Glu Thr Ser Ala Asp Asn Thr Ile Ala Leu Asn Ile Arg Tyr | 340 | 345 | 350 |     |  |     |
| Pro Lys Gly Thr Ser Pro Glu Gln Ile Lys Ser Ile Leu Glu Asn Leu | 355 | 360 | 365 |     |  |     |
| Pro Val Val Ser Val Ser Leu Ser Glu His Gly His Thr Pro His Tyr | 370 | 375 | 380 |     |  |     |
| Val Pro Met Glu Asp Pro Leu Val Gln Thr Leu Leu Asn Ile Tyr Glu | 385 | 390 | 395 |     |  | 400 |
| Lys Gln Thr Gly Phe Lys Gly His Glu Gln Val Ile Gly Gly Gly Thr | 405 | 410 | 415 |     |  |     |
| Phe Gly Arg Leu Leu Glu Arg Gly Val Ala Tyr Gly Ala Met Phe Pro | 420 | 425 | 430 |     |  |     |
| Asp Ser Ile Asp Thr Met His Gln Ala Asn Glu Phe Ile Ala Leu Asp | 435 | 440 | 445 |     |  |     |
| Asp Leu Phe Arg Ala Ala Ala Ile Tyr Ala Glu Ala Ile Tyr Glu Leu |     |     |     |     |  |     |

450

455

460

Ile Lys

465

&lt;210&gt; 33

&lt;211&gt; 1617

&lt;212&gt; DNA

&lt;213&gt; Streptococcus pneumoniae

&lt;400&gt; 33

```

gtgtatacta ttataaaatc aaatataaaa aaatttagtt tattaacgat atttattggt 60
gctgggtcaat tattgctaatt ttatgcagca actattaatg ctctgggtgtt gaatgaatta 120
attgcgatga atttagagcg gtttttgaaa ttgtcaatct accaaatgat tgtctgggtgt 180
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aatctagaga ttcgaaatag agttgccaca gacatctcta actctaccta tcaagaattt 300
catagtaaatt catcaggaac atatctttcg tggctaaata atgatgttca gacttttaaat 360
gatcaggcgt ttaaacaact ttttttagta ataaaaggaa tttctggtac tatatttgca 420
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gcgctagggtg aattaggagg tcaattatcc tctattattg gtacgaagcc tatttttttta 900
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gtgaatagag attttccggt atatgaagca aaaaatattt gctataagta tggagataaa 1020
gaaatattaa aaaacttaaa tttttgtttt caacgtaatg aaaagtattt aatttttaggt 1080
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gaacgtaaga tattagatag agaggatttg actgtcatta ttgttaccca tgctccgcatt 1560
ccggaactta aacaatattt tactaagata tatcaatttc caaaggattt tatttaa 1617

```

&lt;210&gt; 34

&lt;211&gt; 538

&lt;212&gt; PRT

&lt;213&gt; Streptococcus pneumoniae

&lt;400&gt; 34

```

Met Tyr Thr Ile Ile Lys Ser Asn Ile Lys Lys Phe Ser Leu Leu Thr
  1               5               10              15

Ile Phe Ile Val Ala Gly Gln Leu Leu Leu Ile Tyr Ala Ala Thr Ile
      20              25              30

Asn Ala Leu Val Leu Asn Glu Leu Ile Ala Met Asn Leu Glu Arg Phe
  35              40              45

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Leu Lys Leu Ser Ile Tyr Gln Met Ile Val Trp Cys Gly Ile Ile Phe  
 50 55 60

Leu Asp Trp Val Val Lys Asn Tyr Gln Val Glu Val Ile Gln Glu Phe  
 65 70 75 80

Asn Leu Glu Ile Arg Asn Arg Val Ala Thr Asp Ile Ser Asn Ser Thr  
 85 90 95

Tyr Gln Glu Phe His Ser Lys Ser Ser Gly Thr Tyr Leu Ser Trp Leu  
 100 105 110

Asn Asn Asp Val Gln Thr Leu Asn Asp Gln Ala Phe Lys Gln Leu Phe  
 115 120 125

Leu Val Ile Lys Gly Ile Ser Gly Thr Ile Phe Ala Val Val Thr Leu  
 130 135 140

Asn His Tyr His Trp Ser Leu Thr Val Ala Thr Leu Phe Ser Leu Met  
 145 150 155 160

Ile Met Leu Leu Val Pro Lys Ile Phe Ala Ser Lys Met Arg Glu Val  
 165 170 175

Ser Leu Asn Leu Thr Asn Gln Asn Glu Ala Phe Leu Lys Ser Ser Glu  
 180 185 190

Thr Ile Leu Asn Gly Phe Asp Val Leu Ala Ser Leu Asn Leu Leu Tyr  
 195 200 205

Val Leu Pro Lys Lys Ile Lys Glu Ala Gly Ile Leu Leu Lys Met Val  
 210 215 220

Ile Gln Arg Lys Thr Thr Val Glu Thr Leu Ala Gly Ala Ile Ser Phe  
 225 230 235 240

Phe Leu Asn Ile Phe Phe Gln Ile Ser Leu Val Phe Leu Thr Gly Tyr  
 245 250 255

Leu Ala Ile Lys Gly Ile Val Lys Ile Gly Thr Ile Glu Ala Ile Gly  
 260 265 270

Ala Leu Thr Gly Val Ile Phe Thr Ala Leu Gly Glu Leu Gly Gly Gln  
 275 280 285

Leu Ser Ser Ile Ile Gly Thr Lys Pro Ile Phe Leu Lys Leu Tyr Ser  
 290 295 300

Ile Asn Pro Ile Glu Ser Asn Lys Met Asn Asp Ile Glu Pro Asn Glu  
 305 310 315 320

Val Asn Arg Asp Phe Pro Leu Tyr Glu Ala Lys Asn Ile Cys Tyr Lys  
 325 330 335

Tyr Gly Asp Lys Glu Ile Leu Lys Asn Leu Asn Phe Cys Phe Gln Arg  
 340 345 350

Asn Glu Lys Tyr Leu Ile Leu Gly Glu Ser Gly Ser Gly Lys Ser Thr  
 355 360 365  
 Leu Leu Lys Leu Leu Asn Gly Phe Leu Arg Asp Tyr Ser Gly Glu Leu  
 370 375 380  
 Arg Phe Cys Gly Asp Asp Ile Lys Lys Thr Ser Tyr Leu Asn Met Val  
 385 390 395 400  
 Ser Asn Val Leu Tyr Val Asp Gln Lys Ala Tyr Leu Phe Glu Gly Thr  
 405 410 415  
 Ile Arg Asp Asn Ile Leu Leu Glu Glu Asn Tyr Thr Asp Glu Glu Ile  
 420 425 430  
 Leu Gln Ser Leu Glu Gln Val Gly Leu Ser Val Lys Asp Phe Pro Asn  
 435 440 445  
 Asn Ile Leu Asp Tyr Tyr Val Gly Asp Asp Gly Arg Leu Leu Ser Gly  
 450 455 460  
 Gly Gln Lys Gln Lys Ile Thr Leu Ala Arg Gly Leu Ile Arg Asn Lys  
 465 470 475 480  
 Lys Ile Val Leu Ile Asp Glu Gly Thr Ser Ala Ile Asp Arg Arg Thr  
 485 490 495  
 Ser Leu Ala Ile Glu Arg Lys Ile Leu Asp Arg Glu Asp Leu Thr Val  
 500 505 510  
 Ile Ile Val Thr His Ala Pro His Pro Glu Leu Lys Gln Tyr Phe Thr  
 515 520 525  
 Lys Ile Tyr Gln Phe Pro Lys Asp Phe Ile  
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<210> 35

<211> 705

<212> DNA

<213> Streptococcus pneumoniae

<400> 35

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 cgaaccaact cccttttgac taatgagcga tcaaattattg aaaaacaagc cctccaaacg 180  
 gcagaaaaac aagaaatagc ccatttttgca ggcagtctag tagaagaaag agaaactatt 240  
 ttcattggac caggaacaac attagagttt tttgcgcgtg agttgcctat tgacaatatc 300  
 cgcgtcgtaa ccaacagtct acctgttttt ctgattttta gccaacgaaa attaacagat 360  
 ttgattttta taggtggaaa ttatcgcgat attacaggtg cttttgttgg tacattgacc 420  
 ctacaaaatc tctctaattc ccaattttct aaagctttcg ttagctgtaa tggatttcaa 480  
 aacggagctc tagctacttt tagcgaggaa gagggagagg ctcaacgcat cgcttttaaat 540  
 aattctaata aaaaatatatt actcgcagat catagcaagt tcaataagtt tgatttttat 600  
 actttttata atgtatcaaa tcttgatact attgtttcag attctaaact aagtgattca 660  
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<210> 36  
 <211> 234  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 36

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ile | Thr | Val | Lys | Gln | Ile | Met | Asp | Glu | Ile | Ala | Val | Ser | Asp | Met | Thr |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |
| Ala | Arg | Arg | Tyr | Leu | Gln | Glu | Leu | Ala | Asp | Lys | Asp | Leu | Leu | Ile | Arg |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |
| Val | His | Gly | Gly | Ala | Glu | Lys | Leu | Arg | Thr | Asn | Ser | Leu | Leu | Thr | Asn |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |
| Glu | Arg | Ser | Asn | Ile | Glu | Lys | Gln | Ala | Leu | Gln | Thr | Ala | Glu | Lys | Gln |
|     | 50  |     |     |     |     | 55  |     |     |     | 60  |     |     |     |     |     |
| Glu | Ile | Ala | His | Phe | Ala | Gly | Ser | Leu | Val | Glu | Glu | Arg | Glu | Thr | Ile |
|     | 65  |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |
| Phe | Ile | Gly | Pro | Gly | Thr | Thr | Leu | Glu | Phe | Phe | Ala | Arg | Glu | Leu | Pro |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |
| Ile | Asp | Asn | Ile | Arg | Val | Val | Thr | Asn | Ser | Leu | Pro | Val | Phe | Leu | Ile |
|     |     | 100 |     |     |     |     |     | 105 |     |     |     |     | 110 |     |     |
| Leu | Ser | Glu | Arg | Lys | Leu | Thr | Asp | Leu | Ile | Leu | Ile | Gly | Gly | Asn | Tyr |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Arg | Asp | Ile | Thr | Gly | Ala | Phe | Val | Gly | Thr | Leu | Thr | Leu | Gln | Asn | Leu |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
| Ser | Asn | Leu | Gln | Phe | Ser | Lys | Ala | Phe | Val | Ser | Cys | Asn | Gly | Ile | Gln |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |
| Asn | Gly | Ala | Leu | Ala | Thr | Phe | Ser | Glu | Glu | Glu | Gly | Glu | Ala | Gln | Arg |
|     |     |     | 165 |     |     |     |     |     | 170 |     |     |     |     | 175 |     |
| Ile | Ala | Leu | Asn | Asn | Ser | Asn | Lys | Lys | Tyr | Leu | Leu | Ala | Asp | His | Ser |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Lys | Phe | Asn | Lys | Phe | Asp | Phe | Tyr | Thr | Phe | Tyr | Asn | Val | Ser | Asn | Leu |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| Asp | Thr | Ile | Val | Ser | Asp | Ser | Lys | Leu | Ser | Asp | Ser | Ile | Leu | Phe | Lys |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
| Leu | Ser | Lys | His | Ile | Lys | Val | Ile | Lys | Pro |     |     |     |     |     |     |
| 225 |     |     |     |     | 230 |     |     |     |     |     |     |     |     |     |     |

<210> 37  
 <211> 483  
 <212> DNA

<213> Streptococcus pneumoniae

<400> 37

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caatccatct ttatcgaaca caagggaat tatgcttatc gccgggttca tttagaacta 180
agaaatcgtg gttatctggt aaatcataaa agagttcaag gcttgatgaa agtactcaat 240
ttacaagcta aaatgcgaaa gaaacgaaaa tattcttctc ataaaggaga cgttggtaag 300
aaggcagaga atctcattca agcccaattt gaaggctcta aaacaatgga aaagtgctac 360
acagatgtga ctgaatttgc cattccagca agtactcaaa agctttactt atcaccagtt 420
ttagatggct ttaacagcga aattattgct tttaatcttt cttgttcgcc taatttagaa 480
taa 483
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<210> 38

<211> 160

<212> PRT

<213> Streptococcus pneumoniae

<400> 38

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Met Thr Glu Phe Ser Leu Asp Leu Leu Leu Glu Ala Ile Lys Leu Ala
  1              5              10              15

Arg Trp Thr Tyr Tyr Tyr His Leu Lys Gln Leu Asp Lys Thr Asp Lys
      20              25              30

Asp Gln Glu Leu Lys Thr Glu Ile Gln Ser Ile Phe Ile Glu His Lys
      35              40              45

Gly Asn Tyr Ala Tyr Arg Arg Val His Leu Glu Leu Arg Asn Arg Gly
      50              55              60

Tyr Leu Val Asn His Lys Arg Val Gln Gly Leu Met Lys Val Leu Asn
      65              70              75              80

Leu Gln Ala Lys Met Arg Lys Lys Arg Lys Tyr Ser Ser His Lys Gly
      85              90              95

Asp Val Gly Lys Lys Ala Glu Asn Leu Ile Gln Ala Gln Phe Glu Gly
      100              105              110

Ser Lys Thr Met Glu Lys Cys Tyr Thr Asp Val Thr Glu Phe Ala Ile
      115              120              125

Pro Ala Ser Thr Gln Lys Leu Tyr Leu Ser Pro Val Leu Asp Gly Phe
      130              135              140

Asn Ser Glu Ile Ile Ala Phe Asn Leu Ser Cys Ser Pro Asn Leu Glu
      145              150              155              160
```

<210> 39

<211> 1266



<212> DNA

<213> Streptococcus pneumoniae

<400> 39

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gaaaaaaatc gcttgcttgc agcaggggaat gactttaact ttgtaaccaa tgtggatgat 180
attttatcag accaggatat tactatcgta gtggaattga tggggcgtat tgagcctgct 240
aaaaccttta tcaactcgtgc cttggaagct ggaaaacacg ttgttactgc taacaaggac 300
cttttagctg tccatggcgc agaattgcta gaaatcgctc aagctaacaa ggtagcactt 360
tactacgaag cagcagttgc tgggtgggatt ccaattcttc gtactttagc aaattccttg 420
gcttctgata aaattacgcg cgtgcttgga gtagtcaacg gaacttccaa cttcatgggtg 480
accaagatgg tggaagaagg ctggtcttac gatgatgctc ttgcggaagc acaacgtcta 540
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gttattttga gccaatttgc ctttggcatg aagattgcct ttgatgatgt agcccacaag 660
ggaatccgca atatcacacc agaagacgta gctgtagctc aagagcttgg ttacgtagtg 720
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gaataa
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<210> 40

<211> 421

<212> PRT

<213> Streptococcus pneumoniae

<400> 40

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Pro Gly Phe Gly Thr Val Ala Ser Gly Val Pro Phe Leu Leu Lys Glu
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Asn Gly Gly Lys Ile Asn Gln Ser Ala His Ser Asp Ile Lys Val Ala
 20                25                30

Lys Val Leu Val Lys Asp Glu Asp Glu Lys Asn Arg Leu Leu Ala Ala
 35                40                45

Gly Asn Asp Phe Asn Phe Val Thr Asn Val Asp Asp Ile Leu Ser Asp
 50                55                60

Gln Asp Ile Thr Ile Val Val Glu Leu Met Gly Arg Ile Glu Pro Ala
 65                70                75                80

Lys Thr Phe Ile Thr Arg Ala Leu Glu Ala Gly Lys His Val Val Thr
 85                90                95

Ala Asn Lys Asp Leu Leu Ala Val His Gly Ala Glu Leu Leu Glu Ile
100                105                110

Ala Gln Ala Asn Lys Val Ala Leu Tyr Tyr Glu Ala Ala Val Ala Gly
115                120                125
```

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Gly | Ile | Pro | Ile | Leu | Arg | Thr | Leu | Ala | Asn | Ser | Leu | Ala | Ser | Asp | Lys | 130 | 135 | 140 |     |
| Ile | Thr | Arg | Val | Leu | Gly | Val | Val | Asn | Gly | Thr | Ser | Asn | Phe | Met | Val | 145 | 150 | 155 | 160 |
| Thr | Lys | Met | Val | Glu | Glu | Gly | Trp | Ser | Tyr | Asp | Asp | Ala | Leu | Ala | Glu | 165 | 170 | 175 |     |
| Ala | Gln | Arg | Leu | Gly | Phe | Ala | Glu | Ser | Asp | Pro | Thr | Asn | Asp | Val | Asp | 180 | 185 | 190 |     |
| Gly | Ile | Asp | Ala | Ala | Tyr | Lys | Met | Val | Ile | Leu | Ser | Gln | Phe | Ala | Phe | 195 | 200 | 205 |     |
| Gly | Met | Lys | Ile | Ala | Phe | Asp | Asp | Val | Ala | His | Lys | Gly | Ile | Arg | Asn | 210 | 215 | 220 |     |
| Ile | Thr | Pro | Glu | Asp | Val | Ala | Val | Ala | Gln | Glu | Leu | Gly | Tyr | Val | Val | 225 | 230 | 235 | 240 |
| Lys | Leu | Val | Gly | Ser | Ile | Glu | Glu | Thr | Ser | Ser | Gly | Ile | Ala | Ala | Glu | 245 | 250 | 255 |     |
| Val | Thr | Pro | Thr | Phe | Leu | Pro | Lys | Ala | His | Pro | Leu | Ala | Ser | Val | Asn | 260 | 265 | 270 |     |
| Gly | Val | Met | Asn | Ala | Val | Phe | Val | Glu | Ser | Ile | Gly | Ile | Gly | Glu | Ser | 275 | 280 | 285 |     |
| Met | Tyr | Tyr | Gly | Pro | Gly | Ala | Gly | Gln | Lys | Pro | Thr | Ala | Thr | Ser | Val | 290 | 295 | 300 |     |
| Val | Ala | Asp | Ile | Val | Arg | Ile | Val | Arg | Arg | Leu | Asn | Asp | Gly | Thr | Ile | 305 | 310 | 315 | 320 |
| Gly | Lys | Asp | Phe | Asn | Glu | Tyr | Ser | Arg | Asp | Leu | Val | Leu | Ala | Asn | Pro | 325 | 330 | 335 |     |
| Glu | Asp | Val | Lys | Ala | Asn | Tyr | Tyr | Phe | Ser | Ile | Leu | Ala | Leu | Asp | Ser | 340 | 345 | 350 |     |
| Lys | Gly | Gln | Val | Leu | Lys | Leu | Ala | Glu | Ile | Phe | Asn | Ala | Gln | Asp | Ile | 355 | 360 | 365 |     |
| Ser | Phe | Lys | Gln | Ile | Leu | Gln | Asp | Gly | Lys | Glu | Gly | Asp | Lys | Ala | Arg | 370 | 375 | 380 |     |
| Val | Val | Ile | Ile | Thr | His | Lys | Ile | Asn | Lys | Ala | Gln | Leu | Glu | Asn | Val | 385 | 390 | 395 | 400 |
| Ser | Ala | Glu | Leu | Lys | Lys | Val | Ser | Glu | Phe | Asp | Leu | Leu | Asn | Thr | Phe | 405 | 410 | 415 |     |
| Lys | Val | Leu | Gly | Glu |     |     |     |     |     |     |     |     |     |     |     | 420 |     |     |     |

<210> 41  
 <211> 1725  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 41  
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 gaccaatctt tacctcaggg agatcaaggt catctctgga tgcagattgg cctgctcctt 180  
 atcctttgcag taattggcgt tttagtggcc ttgatagctc aattttactc agcaaaggca 240  
 gcagtagggt ctgctaagga attgacaaac gatctttatc gtcataattct ttccttgccc 300  
 aaggacagca gagaccgtct gacaacttct agtttggtca ctgcttgac ttcggatacc 360  
 taccagattc agactgggtat caatcaattc ctgctctctt ttttacgagc gccattatc 420  
 gtttttggtg ccatttttat ggcttatcga atctcagctg agttgacttt ctggttctta 480  
 gtcttggttg ccattttgac cattgtcatt gtagggttat ctgattggt caatcctttc 540  
 tacagtagtc tcagaaagaa aacggaccaa ctggttcagg aaacgcgcca gcaattgcaa 600  
 gggatgctgg ttattcgtgc ttttggtcaa gaaaaacgag agttacagat ttttcaaacc 660  
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 aatttggagc agtggcggtc ttggattgcc tatgtacctc aaaaggctga actctttaaa 1260  
 ggaaccattc gttccaactt gactctaggt ttcaatcaag aagtatctga ccaggaactc 1320  
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 gatgctctag ttgaggcagg ggggcgaaat ttctcagggt gacaaaaaca aagattgtct 1440  
 atcgcccagc cagtcttgcg ccaggctccg tttctcatcc tagatgatgc aacctcgga 1500  
 ctggatacca ttacagagtc caagctcttg aaagctatta gagaaaattt tccaaacacg 1560  
 agcttaattt tgatctctca acgaacctca actttacaga tggcggacca gattctctc 1620  
 ttggaaaaag gtgagttgct agctgttggc aagcacgatg acttgatgaa atccagccaa 1680  
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<210> 42  
 <211> 574  
 <212> PRT  
 <213> Streptococcus pneumoniae

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 20 25 30  
 Pro Met Val Ile Ala Gly Ile Val Asp Gln Ser Leu Pro Gln Gly Asp  
 35 40 45  
 Gln Gly His Leu Trp Met Gln Ile Gly Leu Leu Leu Ile Phe Ala Val  
 50 55 60

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
| Ile | Gly | Val | Leu | Val | Ala | Leu | Ile | Ala | Gln | Phe | Tyr | Ser | Ala | Lys | Ala |  |  |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |  |
| Ala | Val | Gly | Ser | Ala | Lys | Glu | Leu | Thr | Asn | Asp | Leu | Tyr | Arg | His | Ile |  |  |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |  |  |
| Leu | Ser | Leu | Pro | Lys | Asp | Ser | Arg | Asp | Arg | Leu | Thr | Thr | Ser | Ser | Leu |  |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |  |
| Val | Thr | Arg | Leu | Thr | Ser | Asp | Thr | Tyr | Gln | Ile | Gln | Thr | Gly | Ile | Asn |  |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |  |
| Gln | Phe | Leu | Arg | Leu | Phe | Leu | Arg | Ala | Pro | Ile | Ile | Val | Phe | Gly | Ala |  |  |
|     |     | 130 |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |  |
| Ile | Phe | Met | Ala | Tyr | Arg | Ile | Ser | Ala | Glu | Leu | Thr | Phe | Trp | Phe | Leu |  |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |  |
| Val | Leu | Val | Ala | Ile | Leu | Thr | Ile | Val | Ile | Val | Gly | Leu | Ser | Arg | Leu |  |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |  |
| Val | Asn | Pro | Phe | Tyr | Ser | Ser | Leu | Arg | Lys | Lys | Thr | Asp | Gln | Leu | Val |  |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |  |
| Gln | Glu | Thr | Arg | Gln | Gln | Leu | Gln | Gly | Met | Arg | Val | Ile | Arg | Ala | Phe |  |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |  |
| Gly | Gln | Glu | Lys | Arg | Glu | Leu | Gln | Ile | Phe | Gln | Thr | Leu | Asn | Gln | Val |  |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |  |
| Tyr | Ala | Arg | Leu | Gln | Glu | Lys | Thr | Gly | Phe | Trp | Ser | Ser | Leu | Leu | Thr |  |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |  |
| Pro | Leu | Thr | Tyr | Leu | Ile | Val | Asn | Gly | Thr | Leu | Leu | Val | Ile | Ile | Trp |  |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |  |
| Gln | Gly | Tyr | Ile | Ser | Ile | Gln | Gly | Gly | Val | Leu | Ser | Gln | Gly | Ala | Leu |  |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |  |
| Ile | Ala | Leu | Ile | Asn | Tyr | Leu | Leu | Gln | Ile | Leu | Val | Glu | Leu | Val | Lys |  |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |  |
| Leu | Ala | Met | Leu | Ile | Asn | Ser | Leu | Asn | Gln | Ser | Tyr | Ile | Ser | Val | Lys |  |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |  |
| Arg | Ile | Glu | Glu | Val | Phe | Val | Glu | Ala | Pro | Glu | Asp | Ile | His | Ser | Glu |  |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |  |
| Leu | Glu | Gln | Lys | Gln | Ala | Thr | Arg | Asp | Lys | Val | Leu | Gln | Val | Gln | Glu |  |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |  |  |
| Leu | Thr | Phe | Thr | Tyr | Pro | Asp | Ala | Ala | Gln | Pro | Ser | Leu | Arg | Tyr | Ile |  |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |  |
| Ser | Phe | Asp | Met | Thr | Gln | Gly | Gln | Ile | Leu | Gly | Ile | Ile | Gly | Gly | Thr |  |  |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |  |  |

Gly Ser Gly Lys Ser Ser Leu Val Gln Leu Leu Leu Gly Leu Tyr Pro  
 370 375 380  
 Val Asp Lys Gly Asn Ile Asp Leu Tyr Gln Asn Gly Arg Ser Pro Leu  
 385 390 395 400  
 Asn Leu Glu Gln Trp Arg Ser Trp Ile Ala Tyr Val Pro Gln Lys Val  
 405 410 415  
 Glu Leu Phe Lys Gly Thr Ile Arg Ser Asn Leu Thr Leu Gly Phe Asn  
 420 425 430  
 Gln Glu Val Ser Asp Gln Glu Leu Trp Gln Ala Leu Glu Ile Ala Gln  
 435 440 445  
 Ala Lys Asp Phe Val Ser Glu Lys Glu Gly Leu Leu Asp Ala Leu Val  
 450 455 460  
 Glu Ala Gly Gly Arg Asn Phe Ser Gly Gly Gln Lys Gln Arg Leu Ser  
 465 470 475 480  
 Ile Ala Arg Ala Val Leu Arg Gln Ala Pro Phe Leu Ile Leu Asp Asp  
 485 490 495  
 Ala Thr Ser Ala Leu Asp Thr Ile Thr Glu Ser Lys Leu Leu Lys Ala  
 500 505 510  
 Ile Arg Glu Asn Phe Pro Asn Thr Ser Leu Ile Leu Ile Ser Gln Arg  
 515 520 525  
 Thr Ser Thr Leu Gln Met Ala Asp Gln Ile Leu Leu Leu Glu Lys Gly  
 530 535 540  
 Glu Leu Leu Ala Val Gly Lys His Asp Asp Leu Met Lys Ser Ser Gln  
 545 550 555 560  
 Val Tyr Cys Glu Ile Asn Ala Ser Gln His Gly Lys Glu Asp  
 565 570

<210> 43

<211> 1224

<212> DNA

<213> Streptococcus pneumoniae

<400> 43

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 ctgcccattt tagggcagca ggtcgccctgg attgccttgg ggcttgtgat tggttttgtg 180  
 gtcattgctct ttaatacaga atttctttgg aaggtgaccc cctttctata tatttttaggc 240  
 ttgggactta tgatcttgcc gattgtattt tataatccaa gcttagttgc atcaacgggt 300  
 gccaaaaact gggatatcaat aaatggaatt accctattcc aaccgtcaga atttatgaag 360  
 atatcctata tcctcatgtt ggctcgtgtc attgtccaat ttacaaagaa acataaggaa 420  
 tggagacgca cggttccgct ggactttttg ttaattttct ggatgattct ctttaccatt 480  
 ccagtcctag ttcttttagc acttcaaagt gacttgggga cggctttggg tttttagtagc 540

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atcttctcag gaatcgtttt attatcaggg gtttcttgga aaattattat cccagtattt 600
gtgactgctg taacaggagt tgctggtttc ttagctatct ttattagcaa ggacggacga 660
gcttttcttc accagattgg aatgccgacc taccaaatta atcggatttt ggcttggtc 720
aatccctttg agtttgccca aacaacgact taccagcagg ctcaagggca gattgccatt 780
gggagtggtg gcttatttgg tcagggattt aatgcttcga atctgcttat cccagttcga 840
gagtcagata tgatttttac ggttattgca gaagattttg gctttattgg ctctgtcctg 900
gttattgccc tctatctcat gttgatttac cgtatgttga agattactct taaatcaa 960
aaccagttct acacttatat ttccacaggt ttgattatga tgttgctctt ccacatcttt 1020
gagaatatcg gtgctgtgac tggactactt cctttgacgg ggattccctt gcctttcatt 1080
tcgcaagggg gatcagctat tatcagtaat ctgattgggtg ttggtttgct tttatcgatg 1140
agttaccaga ctaatctagc tgaagaaaag agcggaaaag tcccattcaa acggaaaaag 1200
gttgatttaa aacaaattaa ataa                                     1224

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<210> 44

<211> 407

<212> PRT

<213> Streptococcus pneumoniae

<400> 44

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Met Lys Arg Ser Leu Asp Ser Arg Val Asp Tyr Ser Leu Leu Leu Pro
  1              5              10              15

Val Phe Phe Leu Leu Val Ile Gly Val Val Ala Ile Tyr Ile Ala Val
      20              25              30

Ser His Asp Tyr Pro Asn Asn Ile Leu Pro Ile Leu Gly Gln Gln Val
      35              40              45

Ala Trp Ile Ala Leu Gly Leu Val Ile Gly Phe Val Val Met Leu Phe
  50              55              60

Asn Thr Glu Phe Leu Trp Lys Val Thr Pro Phe Leu Tyr Ile Leu Gly
  65              70              75              80

Leu Gly Leu Met Ile Leu Pro Ile Val Phe Tyr Asn Pro Ser Leu Val
      85              90              95

Ala Ser Thr Gly Ala Lys Asn Trp Val Ser Ile Asn Gly Ile Thr Leu
     100              105              110

Phe Gln Pro Ser Glu Phe Met Lys Ile Ser Tyr Ile Leu Met Leu Ala
     115              120              125

Arg Val Ile Val Gln Phe Thr Lys Lys His Lys Glu Trp Arg Arg Thr
     130              135              140

Val Pro Leu Asp Phe Leu Leu Ile Phe Trp Met Ile Leu Phe Thr Ile
     145              150              155              160

Pro Val Leu Val Leu Leu Ala Leu Gln Ser Asp Leu Gly Thr Ala Leu
     165              170              175

Val Phe Val Ala Ile Phe Ser Gly Ile Val Leu Leu Ser Gly Val Ser
     180              185              190

Trp Lys Ile Ile Ile Pro Val Phe Val Thr Ala Val Thr Gly Val Ala

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| 195  | 200 | 205 |
|--|-----|-----|
| Gly Phe Leu Ala Ile Phe Ile Ser Lys Asp Gly Arg Ala Phe Leu His<br>210 215 220     |     |     |
| Gln Ile Gly Met Pro Thr Tyr Gln Ile Asn Arg Ile Leu Ala Trp Leu<br>225 230 235 240 |     |     |
| Asn Pro Phe Glu Phe Ala Gln Thr Thr Thr Tyr Gln Gln Ala Gln Gly<br>245 250 255     |     |     |
| Gln Ile Ala Ile Gly Ser Gly Gly Leu Phe Gly Gln Gly Phe Asn Ala<br>260 265 270     |     |     |
| Ser Asn Leu Leu Ile Pro Val Arg Glu Ser Asp Met Ile Phe Thr Val<br>275 280 285     |     |     |
| Ile Ala Glu Asp Phe Gly Phe Ile Gly Ser Val Leu Val Ile Ala Leu<br>290 295 300     |     |     |
| Tyr Leu Met Leu Ile Tyr Arg Met Leu Lys Ile Thr Leu Lys Ser Asn<br>305 310 315 320 |     |     |
| Asn Gln Phe Tyr Thr Tyr Ile Ser Thr Gly Leu Ile Met Met Leu Leu<br>325 330 335     |     |     |
| Phe His Ile Phe Glu Asn Ile Gly Ala Val Thr Gly Leu Leu Pro Leu<br>340 345 350     |     |     |
| Thr Gly Ile Pro Leu Pro Phe Ile Ser Gln Gly Gly Ser Ala Ile Ile<br>355 360 365     |     |     |
| Ser Asn Leu Ile Gly Val Gly Leu Leu Leu Ser Met Ser Tyr Gln Thr<br>370 375 380     |     |     |
| Asn Leu Ala Glu Glu Lys Ser Gly Lys Val Pro Phe Lys Arg Lys Lys<br>385 390 395 400 |     |     |
| Val Val Leu Lys Gln Ile Lys<br>405   |     |     |

<210> 45

<211> 1104

<212> DNA

<213> Streptococcus pneumoniae

<400> 45

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atggtggcta agaaaaaat cttatttttt atgtggtcctt tttctcttgg aggtggtgca 60
gagaagattc tatcaaccat tgtttcaa atctggatccag aaaagtatga tattgatatt 120
cttgaaatgg agcactttga caagggatat gaatctgttc caaagcatgt acgcatttta 180
aatcccttc aagattatcg ccaaaccaga tggttacgag cttttttgtg gagaatgaga 240
atttattttc caagactgac tcgtcgtttg cttgtaaaag atgattatga tgttgaagtt 300
tcttttacca ttatgaatcc accactgttg ttctctaaaa gaagagaagt caagaagata 360
tcttggattc atggaagtat tgaagaactt cttaaggata gctctaaaag agaatacacat 420
agaagccagt tggatgctgc gaatacaatt gtagggattt caaaaaagac cagcaattct 480

```

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atcaaggaag tttatccaga ttatacttct aaattacaga caatctacaa tggatatgat 540
tttcagacta ttctagaaaa atctcaagag aagatcgata tcgagattgc tcctcaaagt 600
atctgtacta tcggacggat tgaggaaaat aagggttctg accgtgtagt ggaagtgata 660
cgattattac accaagaggg aaaaaactat catctctatt ttatcggggc tggtgatatg 720
gaagaggaac tgaaaaaacg agtcaaagag tatgggattg aggactatgt acatttcctt 780
ggttatcaaa aaaatcctta tcagtatcta tctcagacga aagttctttt gtctatgtct 840
aaacaagaag gttttcctgg agtgtatgtg gaggccttga gtctgggact cccttttatc 900
tctacggacg ttggaggggc tgaggaatta tcccaagaag gacgatttgg acaaatcatt 960
gagagcaatc aagaggcagc tcaggcgatt actaattaca tgacttctgc ctcaaacttt 1020
gatgtcgatg aggctagcca attcattcaa caatttacaa ttacaaaaca aatcgaacaa 1080
gtagaaaaac tattagagga gtag                                     1104

```

<210> 46

<211> 367

<212> PRT

<213> Streptococcus pneumoniae

<400> 46

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Met Val Ala Lys Lys Lys Ile Leu Phe Phe Met Trp Ser Phe Ser Leu
  1             5             10             15

Gly Gly Gly Ala Glu Lys Ile Leu Ser Thr Ile Val Ser Asn Leu Asp
      20             25             30

Pro Glu Lys Tyr Asp Ile Asp Ile Leu Glu Met Glu His Phe Asp Lys
      35             40             45

Gly Tyr Glu Ser Val Pro Lys His Val Arg Ile Leu Lys Ser Leu Gln
      50             55             60

Asp Tyr Arg Gln Thr Arg Trp Leu Arg Ala Phe Leu Trp Arg Met Arg
      65             70             75             80

Ile Tyr Phe Pro Arg Leu Thr Arg Arg Leu Leu Val Lys Asp Asp Tyr
      85             90             95

Asp Val Glu Val Ser Phe Thr Ile Met Asn Pro Pro Leu Leu Phe Ser
      100            105            110

Lys Arg Arg Glu Val Lys Lys Ile Ser Trp Ile His Gly Ser Ile Glu
      115            120            125

Glu Leu Leu Lys Asp Ser Ser Lys Arg Glu Ser His Arg Ser Gln Leu
      130            135            140

Asp Ala Ala Asn Thr Ile Val Gly Ile Ser Lys Lys Thr Ser Asn Ser
      145            150            155            160

Ile Lys Glu Val Tyr Pro Asp Tyr Thr Ser Lys Leu Gln Thr Ile Tyr
      165            170            175

Asn Gly Tyr Asp Phe Gln Thr Ile Leu Glu Lys Ser Gln Glu Lys Ile
      180            185            190

Asp Ile Glu Ile Ala Pro Gln Ser Ile Cys Thr Ile Gly Arg Ile Glu
      195            200            205

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Glu Asn Lys Gly Ser Asp Arg Val Val Glu Val Ile Arg Leu Leu His  
 210 215 220  
 Gln Glu Gly Lys Asn Tyr His Leu Tyr Phe Ile Gly Ala Gly Asp Met  
 225 230 235 240  
 Glu Glu Glu Leu Lys Lys Arg Val Lys Glu Tyr Gly Ile Glu Asp Tyr  
 245 250 255  
 Val His Phe Leu Gly Tyr Gln Lys Asn Pro Tyr Gln Tyr Leu Ser Gln  
 260 265 270  
 Thr Lys Val Leu Leu Ser Met Ser Lys Gln Glu Gly Phe Pro Gly Val  
 275 280 285  
 Tyr Val Glu Ala Leu Ser Leu Gly Leu Pro Phe Ile Ser Thr Asp Val  
 290 295 300  
 Gly Gly Ala Glu Glu Leu Ser Gln Glu Gly Arg Phe Gly Gln Ile Ile  
 305 310 315 320  
 Glu Ser Asn Gln Glu Ala Ala Gln Ala Ile Thr Asn Tyr Met Thr Ser  
 325 330 335  
 Ala Ser Asn Phe Asp Val Asp Glu Ala Ser Gln Phe Ile Gln Gln Phe  
 340 345 350  
 Thr Ile Thr Lys Gln Ile Glu Gln Val Glu Lys Leu Leu Glu Glu  
 355 360 365

<210> 47

<211> 987

<212> DNA

<213> Streptococcus pneumoniae

<400> 47

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aaatcgatag cttccattca gaagcagacc tatcaaaatc tggaaattat tcttgttgat 120
gatggtgcaa cagatgaaag tggtcgcttg tgtgattcaa tcgctgaaca agatgacagg 180
gtgtcagtcg ttcataaaaa gaacgaagga ttgtcgcaag cacgaaatga tgggatgaag 240
caggctcacg gggattatct gatttttatt gactcagatg attatatcca tccagaaatg 300
attcagagct tatatgagca attagttcaa gaagatgcgg atgtttcgag ctgtggtgtc 360
atgaatgtct atgctaata tgaaagccca cagtcagcca atcaggatga ctattttgtc 420
tgtgattctc aaacatttct aaaggaatac ctcatagggtg aaaaaatacc tgggacgatt 480
tgcaataagc taatcaagag acagattgca actgccctat cctttcctaa ggggttgatt 540
tacgaagatg cctattacca ttttgattta atcaagttgg ccaagaagta tgtggttaat 600
actaaaccct attattacta ttccataga ggggatagta ttacgaccaa accctatgca 660
gagaaggatt tagcctatat tgatatctac caaaagtttt ataatagaat tgtgaaaaac 720
tatactgact tgaaaagagg cgcttttttc agattggcct atgccactt ctttattctg 780
gataagatgt tgctagatga tcagtataaa cagtttgaag cctattctca gattcatcgt 840
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attagtgcct tggccctatt cataaatatt tccttatatc gattccttatt actgaaaaat 960
attgaaaaat ctaaaaaatt acattag                                     987
  
```

<210> 48

<211> 328

<212> PRT

<213> Streptococcus pneumoniae

<400> 48

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Glu | Thr | Ala | Leu | Ile | Ser | Val | Ile | Val | Pro | Val | Tyr | Asn | Val | Ala |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |
| Gln | Tyr | Leu | Glu | Lys | Ser | Ile | Ala | Ser | Ile | Gln | Lys | Gln | Thr | Tyr | Gln |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |
| Asn | Leu | Glu | Ile | Ile | Leu | Val | Asp | Asp | Gly | Ala | Thr | Asp | Glu | Ser | Gly |
|     |     |     | 35  |     |     |     | 40  |     |     |     |     | 45  |     |     |     |
| Arg | Leu | Cys | Asp | Ser | Ile | Ala | Glu | Gln | Asp | Asp | Arg | Val | Ser | Val | Leu |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |
| His | Lys | Lys | Asn | Glu | Gly | Leu | Ser | Gln | Ala | Arg | Asn | Asp | Gly | Met | Lys |
|     | 65  |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |
| Gln | Ala | His | Gly | Asp | Tyr | Leu | Ile | Phe | Ile | Asp | Ser | Asp | Asp | Tyr | Ile |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |
| His | Pro | Glu | Met | Ile | Gln | Ser | Leu | Tyr | Glu | Gln | Leu | Val | Gln | Glu | Asp |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |
| Ala | Asp | Val | Ser | Ser | Cys | Gly | Val | Met | Asn | Val | Tyr | Ala | Asn | Asp | Glu |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Ser | Pro | Gln | Ser | Ala | Asn | Gln | Asp | Asp | Tyr | Phe | Val | Cys | Asp | Ser | Gln |
|     |     | 130 |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
| Thr | Phe | Leu | Lys | Glu | Tyr | Leu | Ile | Gly | Glu | Lys | Ile | Pro | Gly | Thr | Ile |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |
| Cys | Asn | Lys | Leu | Ile | Lys | Arg | Gln | Ile | Ala | Thr | Ala | Leu | Ser | Phe | Pro |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |
| Lys | Gly | Leu | Ile | Tyr | Glu | Asp | Ala | Tyr | Tyr | His | Phe | Asp | Leu | Ile | Lys |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Leu | Ala | Lys | Lys | Tyr | Val | Val | Asn | Thr | Lys | Pro | Tyr | Tyr | Tyr | Tyr | Phe |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| His | Arg | Gly | Asp | Ser | Ile | Thr | Thr | Lys | Pro | Tyr | Ala | Glu | Lys | Asp | Leu |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
| Ala | Tyr | Ile | Asp | Ile | Tyr | Gln | Lys | Phe | Tyr | Asn | Glu | Val | Val | Lys | Asn |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |
| Tyr | Pro | Asp | Leu | Lys | Glu | Val | Ala | Phe | Phe | Arg | Leu | Ala | Tyr | Ala | His |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |
| Phe | Phe | Ile | Leu | Asp | Lys | Met | Leu | Leu | Asp | Asp | Gln | Tyr | Lys | Gln | Phe |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |

Glu Ala Tyr Ser Gln Ile His Arg Phe Leu Lys Gly His Ala Phe Ala  
275 280 285

Ile Ser Arg Asn Pro Ile Phe Arg Lys Gly Arg Arg Ile Ser Ala Leu  
290 295 300

Ala Leu Phe Ile Asn Ile Ser Leu Tyr Arg Phe Leu Leu Leu Lys Asn  
305 310 315 320

Ile Glu Lys Ser Lys Lys Leu His  
325

<210> 49

<211> 735

<212> DNA

<213> Streptococcus pneumoniae

<400> 49

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gggtctagcag ggagaaatgg agttggtaag agtacgttga tgaaaattct tgttcagaat 180  
aatcaaccga cttcaggtaa tattataagc agtgataatg ttgggtatct aatcgaagaa 240  
ccaaaattat ttttatctaa aacaggttta gagaatttaa aatatttgct aaatttatat 300  
gggtgttgact acaatcaaga aagattttaga tgtttgatcc aagagttaga tttgactcag 360  
tctattaata aaaaagtaaa gacctattct ttgggtacaa aacaaaaatt agctttgctt 420  
ctaactctcg ttacggaacc tgatatattg atttttagatg aaccgactaa tggtttagat 480  
attgaatcat cacaaatagt tttagcgggt ctaaaaaaat tagctttaca tgaaaatgtg 540  
ggaattttta tatcgagtca taaattagaa gacattgaag aaatttgatg gagagttctt 600  
ttcttggaga acgggctttt gacatttcaa aaagtaggaa aagatagtca taatttcttg 660  
tttgagatag ctttttcac agctacagat agagacattt tcattaccaa acaagaattt 720  
tgggatattg ttttag 735

<210> 50

<211> 244

<212> PRT

<213> Streptococcus pneumoniae

<400> 50

Met Arg Ile Lys Glu Lys Thr Asn Asn Ile Asn Gly Gly Ile Lys Asn  
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20 25 30  
Ala Leu Asn Lys Gly Glu Ile Val Gly Leu Ala Gly Arg Asn Gly Val  
35 40 45  
Gly Lys Ser Thr Leu Met Lys Ile Leu Val Gln Asn Asn Gln Pro Thr  
50 55 60  
Ser Gly Asn Ile Ile Ser Ser Asp Asn Val Gly Tyr Leu Ile Glu Glu  
65 70 75 80

Pro Lys Leu Phe Leu Ser Lys Thr Gly Leu Glu Asn Leu Lys Tyr Leu  
                     85                    90                    95  
 Ser Asn Leu Tyr Gly Val Asp Tyr Asn Gln Glu Arg Phe Arg Cys Leu  
                     100                    105                    110  
 Ile Gln Glu Leu Asp Leu Thr Gln Ser Ile Asn Lys Lys Val Lys Thr  
                     115                    120                    125  
 Tyr Ser Leu Gly Thr Lys Gln Lys Leu Ala Leu Leu Leu Thr Leu Val  
                     130                    135                    140  
 Thr Glu Pro Asp Ile Leu Ile Leu Asp Glu Pro Thr Asn Gly Leu Asp  
 145                    150                    155                    160  
 Ile Glu Ser Ser Gln Ile Val Leu Ala Val Leu Lys Lys Leu Ala Leu  
                     165                    170                    175  
 His Glu Asn Val Gly Ile Leu Ile Ser Ser His Lys Leu Glu Asp Ile  
                     180                    185                    190  
 Glu Glu Ile Cys Glu Arg Val Leu Phe Leu Glu Asn Gly Leu Leu Thr  
                     195                    200                    205  
 Phe Gln Lys Val Gly Lys Asp Ser His Asn Phe Leu Phe Glu Ile Ala  
                     210                    215                    220  
 Phe Ser Ser Ala Thr Asp Arg Asp Ile Phe Ile Thr Lys Gln Glu Phe  
 225                    230                    235                    240  
 Trp Asp Ile Val

<210> 51  
 <211> 1704  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 51  
 atgactgaat tagataaacg tcaccgcagt agcatttatg acagcatggt taaatcacct 60  
 aaccgtgcta tgcttcgtgc gactgggatg acagataagg actttgaaac atcgattgtg 120  
 ggagtgattt cgacttgggc ggaaaataca ccatgtaaca ttcacttgca tgatttcggg 180  
 aaactggcta aagaagggtg caaatctgca ggcgcttggc ctgtacagtt tggaaccatt 240  
 accgtagcgg acgggatcgc tatgggaacg cctgggatgc gtttctctct aacatctcgt 300  
 gacatcatcg cgactccat cgaggcggct atgagtggtc acaacgtgga tgccttcgtc 360  
 gctatcggtg gctgtgacaa gaacatgcct ggatctatga ttgctattgc taatatggat 420  
 atcccagcta ttttcgccta tgggtggaact attgcaccgg gaaatcttga tggtaaagat 480  
 atcgacttgg tttctgtctt tgaaggatc ggaaaatgga accacgggtga catgacagct 540  
 gaggacgtga aacgtcttga atgtaatgcc tgccctggcc ctgggtggtg tgggtggtatg 600  
 tatactgcta ataccatggc aactgctatc gaagttctag ggatgagttt gccagggtca 660  
 tcctctcacc cagctgaatc agctgataag aaagaagata tcgaagcagc aggacgtgct 720  
 gttgttaaga tgttggaact tgggtctcaa ccatcagata tcttgactcg tgaagccttt 780  
 gaagatgcta tcaactgaac gatggctctc ggtggttcta caaacgccac tcttcacttg 840  
 ctgcgccattg cccatgccgc aaatgttgac ttgtcacttg aggacttcaa tacgattcaa 900  
 gaacgtgtgc ctcaacttggc cgacttgaaa ccatctggtc agtatgtctt ccaagacctc 960

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tacgaagtcg gtggtgtccc tgcggttatg aagtatttgt tggcaaattg tttccttcac 1020
ggagatcgca tcacatgtac tggtaagact gtagctgaaa acttggtga ctttgcagac 1080
ttgactccag gccaaaaagt tatcatgcca cttgaaaatc caaaacgtgc ggatgggtccg 1140
cttatcatct tgaacgggaa ctttgctcct gacggtgcag ttgccaaggt atcaggtgtt 1200
aaagtgcgtc gtcacgttgg gccagctaag gtctttgact cagaagaaga tgcgattcag 1260
gccgttctga cagatgaaat cgttgatggc gatgtagtcg ttgttcgttt tgttggacct 1320
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cagggagata aggtggccct cttgacggac ggacgtttct ctggtggtac ttatggtctg 1440
gttgttggac atatcgctcc tgaagctcag gatggtggac caattgccta tctccgtacc 1500
ggcgatatcg ttacggttga ccaagatacc aaagaaattt ctatggccgt atccgaagaa 1560
gaacttgaaa aacgcaaggc agaaacaacc ttgccaccac tttacagccg tgggtgtcctc 1620
ggtaaataatg cccacatcgt atcatctgct tcacgcggag ccgtgacaga cttctggaat 1680
atggacaagt caggtaaaaa ataa
1704

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<210> 52

<211> 567

<212> PRT

<213> Streptococcus pneumoniae

<400> 52

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Met Thr Glu Leu Asp Lys Arg His Arg Ser Ser Ile Tyr Asp Ser Met
  1              5              10              15

Val Lys Ser Pro Asn Arg Ala Met Leu Arg Ala Thr Gly Met Thr Asp
      20              25              30

Lys Asp Phe Glu Thr Ser Ile Val Gly Val Ile Ser Thr Trp Ala Glu
      35              40              45

Asn Thr Pro Cys Asn Ile His Leu His Asp Phe Gly Lys Leu Ala Lys
      50              55              60

Glu Gly Val Lys Ser Ala Gly Ala Trp Pro Val Gln Phe Gly Thr Ile
      65              70              75              80

Thr Val Ala Asp Gly Ile Ala Met Gly Thr Pro Gly Met Arg Phe Ser
      85              90              95

Leu Thr Ser Arg Asp Ile Ile Ala Asp Ser Ile Glu Ala Ala Met Ser
      100             105             110

Gly His Asn Val Asp Ala Phe Val Ala Ile Gly Gly Cys Asp Lys Asn
      115             120             125

Met Pro Gly Ser Met Ile Ala Ile Ala Asn Met Asp Ile Pro Ala Ile
      130             135             140

Phe Ala Tyr Gly Gly Thr Ile Ala Pro Gly Asn Leu Asp Gly Lys Asp
      145             150             155             160

Ile Asp Leu Val Ser Val Phe Glu Gly Ile Gly Lys Trp Asn His Gly
      165             170             175

Asp Met Thr Ala Glu Asp Val Lys Arg Leu Glu Cys Asn Ala Cys Pro
      180             185             190

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Gly | Pro | Gly | Gly | Cys | Gly | Gly | Met | Tyr | Thr | Ala | Asn | Thr | Met | Ala | Thr | 195 | 200 | 205 |
| Ala | Ile | Glu | Val | Leu | Gly | Met | Ser | Leu | Pro | Gly | Ser | Ser | Ser | His | Pro | 210 | 215 | 220 |
| Ala | Glu | Ser | Ala | Asp | Lys | Lys | Glu | Asp | Ile | Glu | Ala | Ala | Gly | Arg | Ala | 225 | 230 | 235 |
| Val | Val | Lys | Met | Leu | Glu | Leu | Gly | Leu | Lys | Pro | Ser | Asp | Ile | Leu | Thr | 245 | 250 | 255 |
| Arg | Glu | Ala | Phe | Glu | Asp | Ala | Ile | Thr | Val | Thr | Met | Ala | Leu | Gly | Gly | 260 | 265 | 270 |
| Ser | Thr | Asn | Ala | Thr | Leu | His | Leu | Leu | Ala | Ile | Ala | His | Ala | Ala | Asn | 275 | 280 | 285 |
| Val | Asp | Leu | Ser | Leu | Glu | Asp | Phe | Asn | Thr | Ile | Gln | Glu | Arg | Val | Pro | 290 | 295 | 300 |
| His | Leu | Ala | Asp | Leu | Lys | Pro | Ser | Gly | Gln | Tyr | Val | Phe | Gln | Asp | Leu | 305 | 310 | 315 |
| Tyr | Glu | Val | Gly | Gly | Val | Pro | Ala | Val | Met | Lys | Tyr | Leu | Leu | Ala | Asn | 325 | 330 | 335 |
| Gly | Phe | Leu | His | Gly | Asp | Arg | Ile | Thr | Cys | Thr | Gly | Lys | Thr | Val | Ala | 340 | 345 | 350 |
| Glu | Asn | Leu | Ala | Asp | Phe | Ala | Asp | Leu | Thr | Pro | Gly | Gln | Lys | Val | Ile | 355 | 360 | 365 |
| Met | Pro | Leu | Glu | Asn | Pro | Lys | Arg | Ala | Asp | Gly | Pro | Leu | Ile | Ile | Leu | 370 | 375 | 380 |
| Asn | Gly | Asn | Leu | Ala | Pro | Asp | Gly | Ala | Val | Ala | Lys | Val | Ser | Gly | Val | 385 | 390 | 395 |
| Lys | Val | Arg | Arg | His | Val | Gly | Pro | Ala | Lys | Val | Phe | Asp | Ser | Glu | Glu | 405 | 410 | 415 |
| Asp | Ala | Ile | Gln | Ala | Val | Leu | Thr | Asp | Glu | Ile | Val | Asp | Gly | Asp | Val | 420 | 425 | 430 |
| Val | Val | Val | Arg | Phe | Val | Gly | Pro | Lys | Gly | Gly | Pro | Gly | Met | Pro | Glu | 435 | 440 | 445 |
| Met | Leu | Ser | Leu | Ser | Ser | Met | Ile | Val | Gly | Lys | Gly | Gln | Gly | Asp | Lys | 450 | 455 | 460 |
| Val | Ala | Leu | Leu | Thr | Asp | Gly | Arg | Phe | Ser | Gly | Gly | Thr | Tyr | Gly | Leu | 465 | 470 | 475 |
| Val | Val | Gly | His | Ile | Ala | Pro | Glu | Ala | Gln | Asp | Gly | Gly | Pro | Ile | Ala | 485 | 490 | 495 |

Tyr Leu Arg Thr Gly Asp Ile Val Thr Val Asp Gln Asp Thr Lys Glu  
 500 505 510  
 Ile Ser Met Ala Val Ser Glu Glu Glu Leu Glu Lys Arg Lys Ala Glu  
 515 520 525  
 Thr Thr Leu Pro Pro Leu Tyr Ser Arg Gly Val Leu Gly Lys Tyr Ala  
 530 535 540  
 His Ile Val Ser Ser Ala Ser Arg Gly Ala Val Thr Asp Phe Trp Asn  
 545 550 555 560  
 Met Asp Lys Ser Gly Lys Lys  
 565

<210> 53  
 <211> 274  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 53  
 atgttataat aaaaataaag aatttaagga gaaatacaat atgtcaattt ttattggagg 60  
 agcatggcca tatgcaaacg gttcgttaca tattgggtcac gcggcagcgc ttttaccggg 120  
 ggatattctt gcaagatact atcgtcagaa gggagaggaa gttttatatg tttctggaag 180  
 tgattgtaat ggaacccta tttctatcag agctaaaaaa gaaaataagt ctgtgaaaga 240  
 aattgctgat ttttatcata aggaatttaa tcca 274

<210> 54  
 <211> 91  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 54  
 Cys Tyr Asn Lys Asn Lys Glu Phe Lys Glu Lys Tyr Asn Met Ser Ile  
 1 5 10 15  
 Phe Ile Gly Gly Ala Trp Pro Tyr Ala Asn Gly Ser Leu His Ile Gly  
 20 25 30  
 His Ala Ala Ala Leu Leu Pro Gly Asp Ile Leu Ala Arg Tyr Tyr Arg  
 35 40 45  
 Gln Lys Gly Glu Glu Val Leu Tyr Val Ser Gly Ser Asp Cys Asn Gly  
 50 55 60  
 Thr Pro Ile Ser Ile Arg Ala Lys Lys Glu Asn Lys Ser Val Lys Glu  
 65 70 75 80  
 Ile Ala Asp Phe Tyr His Lys Glu Phe Asn Pro  
 85 90

<210> 55

<211> 1065  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 55  
 atgacaacat tatttttcaaa aattaaagaa gtaacagaac ttgctgcagt ctcagggtcat 60  
 gaagcgcctg tccgtgctta tcttcgtgaa aagttgacac cgcattgtgga tgaagtgggtg 120  
 acagatggct tgggtgggtat ttttggtatc aaacattcag aagctgtgga tgcaccgcgc 180  
 gtcttggtcg cttctcatat ggacgaagtt ggttttatgg tcagcgaaat caagccagat 240  
 ggtaccttcc gtgtcgtaga aatcgggtggc tgggaaccca tgggtgggttag cagccaacgt 300  
 ttcaaactct tgactcgtga tgggtcatgaa attcctgtga tttcagggtc tgttcctccg 360  
 catttgactc gtggaaaggg gggaccaacc atgccagcca ttgccgatat cgtttttgat 420  
 ggtgggtttg cggacaaggc tgaggcagaa agttttggca tccgtcctgg tgataccatt 480  
 gtaccagata gttctgcaat tttgacagcc aatgaaaaaa atatcatctc aaaagcttgg 540  
 gataaccgct acggtgtcct catggtaagc gagctagctg aagctttatc ggggtcaaaaa 600  
 ctccggcaatg aactctatct gggttctaac gtcttcctcg cagttgattg ctcaccagca 720  
 catacctcta caaccaagtt tgaccagaa gtcttcctcg cagttgattg ctcaccagca 720  
 ggtgatgtct acggtgggtca aggcaagatt ggagatggaa ccttgattcg tttctatgat 780  
 ccagggtcact tgcttctccc agggatgaag gatttccttt tgacaacggc tgaagaagct 840  
 ggtatcaagt accaatacta ctgtggtaaa ggcggaacag atgcagggtc agctcatctg 900  
 aaaaatgggtg gtgtcccatc aacaactatc ggtgtctgcg ctctgttatat ccattctcac 960  
 caaacctct atgcaatgga tgacttccta gaagcgcaag ctttcttaca agccttggtg 1020  
 aagaaattgg atcgttcaac ggttgatttg attaaacatt attaa 1065

<210> 56  
 <211> 354  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 56  
 Met Thr Thr Leu Phe Ser Lys Ile Lys Glu Val Thr Glu Leu Ala Ala  
 1 5 10 15  
 Val Ser Gly His Glu Ala Pro Val Arg Ala Tyr Leu Arg Glu Lys Leu  
 20 25 30  
 Thr Pro His Val Asp Glu Val Val Thr Asp Gly Leu Gly Gly Ile Phe  
 35 40 45  
 Gly Ile Lys His Ser Glu Ala Val Asp Ala Pro Arg Val Leu Val Ala  
 50 55 60  
 Ser His Met Asp Glu Val Gly Phe Met Val Ser Glu Ile Lys Pro Asp  
 65 70 75 80  
 Gly Thr Phe Arg Val Val Glu Ile Gly Gly Trp Asn Pro Met Val Val  
 85 90 95  
 Ser Ser Gln Arg Phe Lys Leu Leu Thr Arg Asp Gly His Glu Ile Pro  
 100 105 110  
 Val Ile Ser Gly Ser Val Pro Pro His Leu Thr Arg Gly Lys Gly Gly  
 115 120 125  
 Pro Thr Met Pro Ala Ile Ala Asp Ile Val Phe Asp Gly Gly Phe Ala  
 130 135 140



Asp Lys Ala Glu Ala Glu Ser Phe Gly Ile Arg Pro Gly Asp Thr Ile  
 145 150 155 160  
 Val Pro Asp Ser Ser Ala Ile Leu Thr Ala Asn Glu Lys Asn Ile Ile  
 165 170 175  
 Ser Lys Ala Trp Asp Asn Arg Tyr Gly Val Leu Met Val Ser Glu Leu  
 180 185 190  
 Ala Glu Ala Leu Ser Gly Gln Lys Leu Gly Asn Glu Leu Tyr Leu Gly  
 195 200 205  
 Ser Asn Val Gln Glu Glu Val Gly Leu Arg Gly Ala His Thr Ser Thr  
 210 215 220  
 Thr Lys Phe Asp Pro Glu Val Phe Leu Ala Val Asp Cys Ser Pro Ala  
 225 230 235 240  
 Gly Asp Val Tyr Gly Gly Gln Gly Lys Ile Gly Asp Gly Thr Leu Ile  
 245 250 255  
 Arg Phe Tyr Asp Pro Gly His Leu Leu Leu Pro Gly Met Lys Asp Phe  
 260 265 270  
 Leu Leu Thr Thr Ala Glu Glu Ala Gly Ile Lys Tyr Gln Tyr Tyr Cys  
 275 280 285  
 Gly Lys Gly Gly Thr Asp Ala Gly Ala Ala His Leu Lys Asn Gly Gly  
 290 295 300  
 Val Pro Ser Thr Thr Ile Gly Val Cys Ala Arg Tyr Ile His Ser His  
 305 310 315 320  
 Gln Thr Leu Tyr Ala Met Asp Asp Phe Leu Glu Ala Gln Ala Phe Leu  
 325 330 335  
 Gln Ala Leu Val Lys Lys Leu Asp Arg Ser Thr Val Asp Leu Ile Lys  
 340 345 350  
 His Tyr

<210> 57  
 <211> 1182  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 57  
 atggaatttt ctatgaaatc agtcaaagga ctactcttta tcatagctag ttttatcttg 60  
 actcttttga cttggatgaa cacttctccc caattcatga ttccaggact agctttaaca 120  
 agcctatctc tgacttttat cctagccact cgtctcccac tactagaaag ctgggtttcac 180  
 agtttggaga aggtctacac cgtccacaaa ttcacagcct ttctctcaat catcctacta 240  
 atctttcata acttttagtat gggcggtttg tggggctctc gcttagctgc tcagtttggc 300  
 aatcttgcca tctatatctt tgccagcatc atccttgctg cctatttagg caaatacatc 360

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caatacgaag cttggcgatg gattcacgcg ctggtttacc tagcctatat tttaggactc 420
tttcacatct acatgataat gggcaatcgt ctcccttacat ttaatcttct aagttttctt 480
gttggttagct atgccctttt aggccttacta gctgggtttt atatcatttt tctatatcaa 540
aagatttcct tcccctatct agggaaaatt acccatctca aacgcttaaa tcacgatact 600
agagaaattc aaatccatct tagcagacct ttcaactatc aatcaggaca atttgccttt 660
ctaaagattt tccaagaagg ctttgaaagt gctccgcac ccttttctat ctcaggaggt 720
catggtcaaa ctctttactt tactgttaaa acttcaggcg accataccaa gaatatctat 780
gataatcttc aagccggcag caaagtaacc ctagacagag cttacggaca catgatcata 840
gaagaaggac gagaaaatca ggtttggatt gctggaggta ttgggatcac ccccttcac 900
tcttacatcc gtgaacatcc tatttttagat aaacaggttc acttctacta tagcttccgt 960
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tttgaactcc atctaactga cagtacgaaa gacggctatc ttaattttga acaaaaagaa 1080
gtgcccgaac atgcaaccgt ctatatgtgt ggtcctatct ctatgatgaa ggcacttgcc 1140
aaacagatta agaaaacaaa tccaaaaaca gagcatatct ac 1182

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<210> 58

<211> 394

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 58

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Met Glu Phe Ser Met Lys Ser Val Lys Gly Leu Leu Phe Ile Ile Ala
  1              5              10              15

Ser Phe Ile Leu Thr Leu Leu Thr Trp Met Asn Thr Ser Pro Gln Phe
          20              25              30

Met Ile Pro Gly Leu Ala Leu Thr Ser Leu Ser Leu Thr Phe Ile Leu
  35              40              45

Ala Thr Arg Leu Pro Leu Leu Glu Ser Trp Phe His Ser Leu Glu Lys
  50              55              60

Val Tyr Thr Val His Lys Phe Thr Ala Phe Leu Ser Ile Ile Leu Leu
  65              70              75              80

Ile Phe His Asn Phe Ser Met Gly Gly Leu Trp Gly Ser Arg Leu Ala
          85              90              95

Ala Gln Phe Gly Asn Leu Ala Ile Tyr Ile Phe Ala Ser Ile Ile Leu
          100              105              110

Val Ala Tyr Leu Gly Lys Tyr Ile Gln Tyr Glu Ala Trp Arg Trp Ile
          115              120              125

His Arg Leu Val Tyr Leu Ala Tyr Ile Leu Gly Leu Phe His Ile Tyr
          130              135              140

Met Ile Met Gly Asn Arg Leu Leu Thr Phe Asn Leu Leu Ser Phe Leu
          145              150              155              160

Val Gly Ser Tyr Ala Leu Leu Gly Leu Leu Ala Gly Phe Tyr Ile Ile
          165              170              175

Phe Leu Tyr Gln Lys Ile Ser Phe Pro Tyr Leu Gly Lys Ile Thr His
          180              185              190

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Leu Lys Arg Leu Asn His Asp Thr Arg Glu Ile Gln Ile His Leu Ser  
 195 200 205  
 Arg Pro Phe Asn Tyr Gln Ser Gly Gln Phe Ala Phe Leu Lys Ile Phe  
 210 215 220  
 Gln Glu Gly Phe Glu Ser Ala Pro His Pro Phe Ser Ile Ser Gly Gly  
 225 230 235 240  
 His Gly Gln Thr Leu Tyr Phe Thr Val Lys Thr Ser Gly Asp His Thr  
 245 250 255  
 Lys Asn Ile Tyr Asp Asn Leu Gln Ala Gly Ser Lys Val Thr Leu Asp  
 260 265 270  
 Arg Ala Tyr Gly His Met Ile Ile Glu Glu Gly Arg Glu Asn Gln Val  
 275 280 285  
 Trp Ile Ala Gly Gly Ile Gly Ile Thr Pro Phe Ile Ser Tyr Ile Arg  
 290 295 300  
 Glu His Pro Ile Leu Asp Lys Gln Val His Phe Tyr Tyr Ser Phe Arg  
 305 310 315 320  
 Gly Asp Glu Asn Ala Val Tyr Leu Asp Leu Leu Arg Asn Tyr Ala Gln  
 325 330 335  
 Lys Asn Pro Asn Phe Glu Leu His Leu Ile Asp Ser Thr Lys Asp Gly  
 340 345 350  
 Tyr Leu Asn Phe Glu Gln Lys Glu Val Pro Glu His Ala Thr Val Tyr  
 355 360 365  
 Met Cys Gly Pro Ile Ser Met Met Lys Ala Leu Ala Lys Gln Ile Lys  
 370 375 380  
 Lys Gln Asn Pro Lys Thr Glu His Ile Tyr  
 385 390

<210> 59

<211> 900

<212> DNA

<213> Streptococcus pneumoniae

<400> 59

atgactttta aatcaggctt ttagaccatt ttaggacgtc ccaatggttg gaagtcacac 60  
 tttttaaatc acgttatggg gcaaaagatt gccatcatga gtgacaaggc gcagacaacg 120  
 cgcaataaaa tcatgggaat ttacacgact gataaggagc aaattgtctt tatcgacaca 180  
 ccagggatcc acaagcctaa aacagctctc ggagatttca tggttgagtc tgcctacagt 240  
 acccttcgcg aagtggacac tgttcttttc atgggtgcctg ctgatgaagc gcgtggtaag 300  
 ggggacgata tgattatcga gcgtctcaag gctgccaaagg ttcctgtgat tttgggtgtg 360  
 aataaaatcg ataaggtcca tccagaccag ctcttgtctc agattgatga cttccgtaat 420  
 caaatggact ttaaggaaat tgttccaatc tcagcccttc agggaaataa cgtgtctcgt 480  
 ctagtggata ttttgagtga aaatctggat gaaggtttcc aatatttccc gtctgatcaa 540



|   |     |     |     |
|---|-----|-----|-----|
| 225   | 230 | 235 | 240 |
| Gly Ile Ile Ile Gly Lys Gly Gly Ala Met Leu Lys Lys Ile Gly Ser | 245 | 250 | 255 |
| Met Ala Arg Arg Asp Ile Glu Leu Met Leu Gly Asp Lys Val Phe Leu | 260 | 265 | 270 |
| Glu Thr Trp Val Lys Val Lys Lys Asn Trp Arg Asp Lys Lys Leu Asp | 275 | 280 | 285 |
| Leu Ala Asp Phe Gly Tyr Asn Glu Arg Glu Tyr                     | 290 | 295 |     |

<210> 61  
 <211> 855  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 61  
 ctgcttcttg tttttacaga aggaggactt atgcctgaat tacctgaggt tgaaaccggt 60  
 tgtcgtggct tagaaaaatt gattatagga aagaagattt cgagtataga aattcgctac 120  
 cccaagatga ttaagacgga tttggaagag tttcaaaggg aattgcctag tcagattatc 180  
 gagtcaatgg gacgtcgtgg aaaatatttg cttttttatc tgacagacaa ggtcttgatt 240  
 tcccatattgc ggatggaggg caagtatttt tactatccag accaaggacc tgaacgcaag 300  
 catgcccattg ttttctttca ttttgaagat ggtggcacgc ttgtttatga ggatgttcgc 360  
 aagtttgga ccatggaact cttggtgcct gaccttttag acgtctactt tatttctaaa 420  
 aaattaggtc ctgaaccaag cgaacaagac tttgatttac aggtctttca atctgcccctt 480  
 gccaaagtcca aaaagcctat caaatcccat ctccatagacc agaccttggg agctggactt 540  
 ggcaatatct atgtggatga ggttctctgg cgagctcagg ttcattccagc tagaccttcc 600  
 cagactttga cagcagaaga agcgactgcc attcatgacc agaccattgc tgttttgggc 660  
 caggctgttg aaaaagggtg ctcaccatt cggacttata ccaatgcctt tggggaagat 720  
 ggaagcatgc aggactttca tcaggcttat gataagactg gtcaagaatg tgtacgctgt 780  
 ggtaccatca ttgagaaaat tcaactaggc ggacgtggaa ccacttttg tccaaactgt 840  
 caaaggaggg actga 855

<210> 62  
 <211> 284  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 62  
 Met Leu Leu Val Phe Thr Glu Gly Gly Leu Met Pro Glu Leu Pro Glu  
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 Val Glu Thr Val Cys Arg Gly Leu Glu Lys Leu Ile Ile Gly Lys Lys  
 20 25 30  
 Ile Ser Ser Ile Glu Ile Arg Tyr Pro Lys Met Ile Lys Thr Asp Leu  
 35 40 45  
 Glu Glu Phe Gln Arg Glu Leu Pro Ser Gln Ile Ile Glu Ser Met Gly  
 50 55 60

Arg Arg Gly Lys Tyr Leu Leu Phe Tyr Leu Thr Asp Lys Val Leu Ile  
 65 70 75 80  
 Ser His Leu Arg Met Glu Gly Lys Tyr Phe Tyr Tyr Pro Asp Gln Gly  
 85 90 95  
 Pro Glu Arg Lys His Ala His Val Phe Phe His Phe Glu Asp Gly Gly  
 100 105 110  
 Thr Leu Val Tyr Glu Asp Val Arg Lys Phe Gly Thr Met Glu Leu Leu  
 115 120 125  
 Val Pro Asp Leu Leu Asp Val Tyr Phe Ile Ser Lys Lys Leu Gly Pro  
 130 135 140  
 Glu Pro Ser Glu Gln Asp Phe Asp Leu Gln Val Phe Gln Ser Ala Leu  
 145 150 155 160  
 Ala Lys Ser Lys Lys Pro Ile Lys Ser His Leu Leu Asp Gln Thr Leu  
 165 170 175  
 Val Ala Gly Leu Gly Asn Ile Tyr Val Asp Glu Val Leu Trp Arg Ala  
 180 185 190  
 Gln Val His Pro Ala Arg Pro Ser Gln Thr Leu Thr Ala Glu Glu Ala  
 195 200 205  
 Thr Ala Ile His Asp Gln Thr Ile Ala Val Leu Gly Gln Ala Val Glu  
 210 215 220  
 Lys Gly Gly Ser Thr Ile Arg Thr Tyr Thr Asn Ala Phe Gly Glu Asp  
 225 230 235 240  
 Gly Ser Met Gln Asp Phe His Gln Val Tyr Asp Lys Thr Gly Gln Glu  
 245 250 255  
 Cys Val Arg Cys Gly Thr Ile Ile Glu Lys Ile Gln Leu Gly Gly Arg  
 260 265 270  
 Gly Thr His Phe Cys Pro Asn Cys Gln Arg Arg Asp  
 275 280

<210> 63

<211> 633

<212> DNA

<213> Streptococcus pneumoniae

<400> 63

ttgtccaaac tgtcaaagga gggactgatg ggaaaaatca tcggaatcac tgggggaatt 60  
 gcctctggta agtcaactgt gacaaatctt ctaagacagc aaggctttca agtagtgat 120  
 gccgacgcag tcgtccacca actacagaaa cctgggtggc gtctgtttga ggctctagta 180  
 cagcactttg ggcaagaaat cattcttgaa aacggagaac tcaatcgccc tctcctagct 240  
 agtctcatct tttcaaatac tgatgaacga gaatgggtcta agcaaattca aggggagatt 300  
 atccgtgagg aactggctac tttgagagaa cagttggctc agacagaaga gattttcttc 360  
 atggatattc ccctactttt tgagcaggac tacagcgatt ggtttgctga gacttggttg 420

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gtctatgtgg accgagatgc ccaagtggaa cgcttaatga aaagggacca gttgtccaaa 480
gatgaagctg agtctcgtct ggcagcccag tggccttttag aaaaaaagaa agatttggcc 540
agccaggttc ttgataataa tggcaatcag aaccagcttc ttaatcaagt gcataatcctt 600
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<210> 64

<211> 210

<212> PRT

<213> Streptococcus pneumoniae

<400> 64

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Met Ser Lys Leu Ser Lys Glu Gly Leu Met Gly Lys Ile Ile Gly Ile
  1           5           10          15

Thr Gly Gly Ile Ala Ser Gly Lys Ser Thr Val Thr Asn Phe Leu Arg
  20           25           30

Gln Gln Gly Phe Gln Val Val Asp Ala Asp Ala Val Val His Gln Leu
  35           40           45

Gln Lys Pro Gly Gly Arg Leu Phe Glu Ala Leu Val Gln His Phe Gly
  50           55           60

Gln Glu Ile Ile Leu Glu Asn Gly Glu Leu Asn Arg Pro Leu Leu Ala
  65           70           75           80

Ser Leu Ile Phe Ser Asn Pro Asp Glu Arg Glu Trp Ser Lys Gln Ile
           85           90           95

Gln Gly Glu Ile Ile Arg Glu Glu Leu Ala Thr Leu Arg Glu Gln Leu
 100           105          110

Ala Gln Thr Glu Glu Ile Phe Phe Met Asp Ile Pro Leu Leu Phe Glu
 115           120          125

Gln Asp Tyr Ser Asp Trp Phe Ala Glu Thr Trp Leu Val Tyr Val Asp
 130           135          140

Arg Asp Ala Gln Val Glu Arg Leu Met Lys Arg Asp Gln Leu Ser Lys
 145           150          155          160

Asp Glu Ala Glu Ser Arg Leu Ala Ala Gln Trp Pro Leu Glu Lys Lys
           165          170          175

Lys Asp Leu Ala Ser Gln Val Leu Asp Asn Asn Gly Asn Gln Asn Gln
 180           185          190

Leu Leu Asn Gln Val His Ile Leu Leu Glu Gly Gly Arg Gln Asp Asp
 195           200          205

Arg Asp
 210

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<210> 65

<211> 1269

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 65

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tttctgacag gagccagtat ttctttgggt gtacctttta tgcccattct cgtggaaaat 180
ctaggtgtag ggagtcagca agtcgctttt tatgcaggct tagcaatttc tgtctctgct 240
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tttttaacca gttttgtcat ccaattttca gctcaatcga ttggccctat ttgggctctt 780
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tcgaggggtc ttgccttcaa tcaggtattc ttttatctgg gaggtgttgt tgggtcccatg 1140
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gaaatctag                                     1269
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<210> 66

<211> 422

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 66

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Met Ile Ile Met Ala Ile Arg Thr Ser Phe Leu Ile Lys Cys Ile Ser
 1             5             10            15

Phe Leu Arg Glu Val Gly Lys Met Thr Glu Ile Asn Trp Lys Asp Asn
      20             25            30

Leu Arg Ile Ala Trp Phe Gly Asn Phe Leu Thr Gly Ala Ser Ile Ser
      35             40            45

Leu Val Val Pro Phe Met Pro Ile Phe Val Glu Asn Leu Gly Val Gly
      50             55            60

Ser Gln Gln Val Ala Phe Tyr Ala Gly Leu Ala Ile Ser Val Ser Ala
      65             70            75            80

Ile Ser Ala Ala Leu Phe Ser Pro Ile Trp Gly Ile Leu Ala Asp Lys
      85             90            95

Tyr Gly Arg Lys Pro Met Met Ile Arg Ala Gly Leu Ala Met Thr Ile
      100            105           110

Thr Met Gly Gly Leu Ala Phe Val Pro Asn Ile Tyr Trp Leu Ile Phe
```



| 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Leu | Arg | Leu | Leu | Asn | Gly | Val | Phe | Ala | Gly | Phe | Val | Pro | Asn | Ala | Thr |
| 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |     |
| Ala | Leu | Ile | Ala | Ser | Gln | Val | Pro | Lys | Glu | Lys | Ser | Gly | Ser | Ala | Leu |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |
| Gly | Thr | Leu | Ser | Thr | Gly | Val | Val | Ala | Gly | Thr | Leu | Thr | Gly | Pro | Phe |
|     |     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |
| Ile | Gly | Gly | Phe | Ile | Ala | Glu | Leu | Phe | Gly | Ile | Arg | Thr | Val | Phe | Leu |
|     |     |     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |
| Leu | Val | Gly | Ser | Phe | Leu | Phe | Leu | Ala | Ala | Ile | Leu | Thr | Ile | Cys | Phe |
|     |     |     |     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |
| Ile | Lys | Glu | Asp | Phe | Gln | Pro | Val | Ala | Lys | Glu | Lys | Ala | Ile | Pro | Thr |
|     |     |     |     |     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |
| Lys | Glu | Leu | Phe | Thr | Ser | Val | Lys | Tyr | Pro | Tyr | Leu | Leu | Leu | Asn | Leu |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |
| Phe | Leu | Thr | Ser | Phe | Val | Ile | Gln | Phe | Ser | Ala | Gln | Ser | Ile | Gly | Pro |
|     |     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |
| Ile | Leu | Ala | Leu | Tyr | Val | Arg | Asp | Leu | Gly | Gln | Thr | Glu | Asn | Leu | Leu |
|     |     |     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |
| Phe | Val | Ser | Gly | Leu | Ile | Val | Ser | Ser | Met | Gly | Phe | Ser | Ser | Met | Met |
|     |     |     |     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |
| Ser | Ala | Gly | Val | Met | Gly | Lys | Leu | Gly | Asp | Lys | Val | Gly | Asn | His | Arg |
| 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |     |
| Leu | Leu | Val | Val | Ala | Gln | Phe | Tyr | Ser | Val | Ile | Ile | Tyr | Leu | Leu | Cys |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |
| Ala | Asn | Ala | Ser | Ser | Pro | Leu | Gln | Leu | Gly | Leu | Tyr | Arg | Phe | Leu | Phe |
|     |     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |
| Gly | Leu | Gly | Thr | Gly | Ala | Leu | Ile | Pro | Gly | Val | Asn | Ala | Leu | Leu | Ser |
|     |     |     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |
| Lys | Met | Thr | Pro | Lys | Ala | Gly | Ile | Ser | Arg | Val | Phe | Ala | Phe | Asn | Gln |
|     |     |     |     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |
| Val | Phe | Phe | Tyr | Leu | Gly | Gly | Val | Val | Gly | Pro | Met | Ala | Gly | Ser | Ala |
| 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |     |
| Val | Ala | Gly | Gln | Phe | Gly | Tyr | His | Ala | Val | Phe | Tyr | Ala | Thr | Ser | Leu |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |
| Cys | Val | Ala | Phe | Ser | Cys | Leu | Phe | Asn | Leu | Ile | Gln | Phe | Arg | Thr | Leu |
|     |     |     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |
| Leu | Lys | Val | Lys | Glu | Ile |     |     |     |     |     |     |     |     |     |     |

&lt;210&gt; 67

&lt;211&gt; 1311

&lt;212&gt; DNA

&lt;213&gt; Streptococcus pneumoniae

&lt;400&gt; 67

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cgtatttatg caacgggtga gtggctcaat cgttctttta gcatgattga tacaggagga 180
attgatgatg tcgatgctcc tttcatggaa caaatcaagc accaggcaga aattgccatg 240
gaagaagcag atgttatcgt ttttgtcgtg tctggtaagg aaggaattac tgatgcagac 300
gaatacgtag ctcgtaagct ttataagacc cacaaaccag ttatcctcgc agtcaacaag 360
gtggacaacc ctgagatgag aaatgatata tatgatttct atgctctcgc tttgggtgaa 420
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gatggtcaag agtttaccat gattgatacg gctggtatgc gtaagtctgg taaggtttat 720
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gaagaagaac tcatgcactt ttcttacctg cgtttcttgg aaaatcaaat ccgcaaggcc 1260
tttgtttttg agggaacacc gattcatctc atcgcaagaa aacgcaaata a 1311

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&lt;210&gt; 68

&lt;211&gt; 436

&lt;212&gt; PRT

&lt;213&gt; Streptococcus pneumoniae

&lt;400&gt; 68

```

Met Ala Leu Pro Thr Ile Ala Ile Val Gly Arg Pro Asn Val Gly Lys
  1                      5                      10                      15

Ser Thr Leu Phe Asn Arg Ile Ala Gly Glu Arg Ile Ser Ile Val Glu
                20                      25                      30

Asp Val Glu Gly Val Thr Arg Asp Arg Ile Tyr Ala Thr Gly Glu Trp
    35                      40                      45

Leu Asn Arg Ser Phe Ser Met Ile Asp Thr Gly Gly Ile Asp Asp Val
    50                      55                      60

Asp Ala Pro Phe Met Glu Gln Ile Lys His Gln Ala Glu Ile Ala Met
    65                      70                      75                      80

Glu Glu Ala Asp Val Ile Val Phe Val Val Ser Gly Lys Glu Gly Ile
    85                      90                      95

```

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Thr | Asp | Ala | Asp | Glu | Tyr | Val | Ala | Arg | Lys | Leu | Tyr | Lys | Thr | His | Lys |
|     |     |     | 100 |     |     |     |     |     | 105 |     |     |     | 110 |     |     |
| Pro | Val | Ile | Leu | Ala | Val | Asn | Lys | Val | Asp | Asn | Pro | Glu | Met | Arg | Asn |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Asp | Ile | Tyr | Asp | Phe | Tyr | Ala | Leu | Gly | Leu | Gly | Glu | Pro | Leu | Pro | Ile |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
| Ser | Ser | Val | His | Gly | Ile | Gly | Thr | Gly | Asp | Val | Leu | Asp | Ala | Ile | Val |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |
| Glu | Asn | Leu | Pro | Asn | Glu | Tyr | Glu | Glu | Glu | Asn | Pro | Asp | Val | Ile | Lys |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |
| Phe | Ser | Leu | Ile | Gly | Arg | Pro | Asn | Val | Gly | Lys | Ser | Ser | Leu | Ile | Asn |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Ala | Ile | Leu | Gly | Glu | Asp | Arg | Val | Ile | Ala | Ser | Pro | Val | Ala | Gly | Thr |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| Thr | Arg | Asp | Ala | Ile | Asp | Thr | His | Phe | Thr | Asp | Thr | Asp | Gly | Gln | Glu |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
| Phe | Thr | Met | Ile | Asp | Thr | Ala | Gly | Met | Arg | Lys | Ser | Gly | Lys | Val | Tyr |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |
| Glu | Asn | Thr | Glu | Lys | Tyr | Ser | Val | Met | Arg | Ala | Met | Arg | Ala | Ile | Asp |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |
| Arg | Ser | Asp | Val | Val | Leu | Met | Val | Ile | Asn | Ala | Glu | Glu | Gly | Ile | Arg |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| Glu | Tyr | Asp | Lys | Arg | Ile | Ala | Gly | Phe | Ala | His | Glu | Ala | Gly | Lys | Gly |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |
| Met | Ile | Ile | Val | Val | Asn | Lys | Trp | Asp | Thr | Leu | Glu | Lys | Asp | Asn | His |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |
| Thr | Met | Lys | Asn | Trp | Glu | Glu | Asp | Ile | Arg | Glu | Gln | Phe | Gln | Tyr | Leu |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |
| Pro | Tyr | Ala | Pro | Ile | Ile | Phe | Val | Ser | Ala | Leu | Thr | Lys | Gln | Arg | Leu |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |
| His | Lys | Leu | Pro | Glu | Met | Ile | Lys | Gln | Ile | Ser | Glu | Ser | Gln | Asn | Thr |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |
| Arg | Ile | Pro | Ser | Ala | Val | Leu | Asn | Asp | Val | Ile | Met | Asp | Ala | Ile | Ala |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |
| Ile | Asn | Pro | Thr | Pro | Thr | Asp | Lys | Gly | Lys | Arg | Leu | Lys | Ile | Phe | Tyr |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |
| Ala | Thr | Gln | Val | Ala | Thr | Lys | Pro | Pro | Thr | Phe | Val | Ile | Phe | Val | Asn |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |

Glu Glu Glu Leu Met His Phe Ser Tyr Leu Arg Phe Leu Glu Asn Gln  
405 410 415

Ile Arg Lys Ala Phe Val Phe Glu Gly Thr Pro Ile His Leu Ile Ala  
420 425 430

Arg Lys Arg Lys  
435

<210> 69

<211> 714

<212> DNA

<213> Streptococcus pneumoniae

<400> 69

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aagaatttcc aatcctactc tgtgattgtg gtacgaagtc aagagaagaa agatgccttg 180  
tatgaattgg tacctcaaga agccattcgc cagtctgctg ttttccttct ctttgtcggg 240  
gatttgaacc gagcagaaaa gggagcccg cttcataccg acaccttcca accccaaggt 300  
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gcagctgaaa gcttgggcta tgggtggtgtg attatcggtt tggttcgata caagtctgaa 420  
gaagtggcag agctctttaa cctacctgac tacacctatt ctgtccttgg gatggcactg 480  
ggtgtgccaa atcaacatca tgatatgaaa ccgagactgc cactagagaa tgttgtcttt 540  
gaggaagaat accaagaaca gtcaactgag gcaatccaag cttatgaccg tgttcagggt 600  
gactatgctg gggcgctgc gaccacaagc tggagtcagc gcctagcaga acagtttggt 660  
caagctgaac caagctcaac tagaaaaaat cttgaacaga agaaattatt gtag 714

<210> 70

<211> 237

<212> PRT

<213> Streptococcus pneumoniae

<400> 70

Met Thr Glu Thr Ile Lys Leu Met Lys Ala His Thr Ser Val Arg Arg  
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Phe Lys Glu Gln Glu Ile Pro Gln Val Asp Leu Asn Glu Ile Leu Thr  
20 25 30

Ala Ala Gln Met Ala Ser Ser Trp Lys Asn Phe Gln Ser Tyr Ser Val  
35 40 45

Ile Val Val Arg Ser Gln Glu Lys Lys Asp Ala Leu Tyr Glu Leu Val  
50 55 60

Pro Gln Glu Ala Ile Arg Gln Ser Ala Val Phe Leu Leu Phe Val Gly  
65 70 75 80

Asp Leu Asn Arg Ala Glu Lys Gly Ala Arg Leu His Thr Asp Thr Phe  
85 90 95

Gln Pro Gln Gly Val Glu Gly Leu Leu Ile Ser Ser Val Asp Ala Ala

|   |     |     |
|---|-----|-----|
| 100   | 105 | 110 |
| Leu Ala Gly Gln Asn Ala Leu Leu Ala Ala Glu Ser Leu Gly Tyr Gly |     |     |
| 115   | 120 | 125 |
| Gly Val Ile Ile Gly Leu Val Arg Tyr Lys Ser Glu Glu Val Ala Glu |     |     |
| 130   | 135 | 140 |
| Leu Phe Asn Leu Pro Asp Tyr Thr Tyr Ser Val Phe Gly Met Ala Leu |     |     |
| 145   | 150 | 155 |
| Gly Val Pro Asn Gln His His Asp Met Lys Pro Arg Leu Pro Leu Glu |     |     |
|   | 165 | 170 |
| Asn Val Val Phe Glu Glu Glu Tyr Gln Glu Gln Ser Thr Glu Ala Ile |     |     |
|   | 180 | 185 |
| Gln Ala Tyr Asp Arg Val Gln Ala Asp Tyr Ala Gly Ala Arg Ala Thr |     |     |
| 195   | 200 | 205 |
| Thr Ser Trp Ser Gln Arg Leu Ala Glu Gln Phe Gly Gln Ala Glu Pro |     |     |
| 210   | 215 | 220 |
| Ser Ser Thr Arg Lys Asn Leu Glu Gln Lys Lys Leu Leu             |     |     |
| 225   | 230 | 235 |

<210> 71

<211> 729

<212> DNA

<213> Streptococcus pneumoniae

<400> 71

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| gatatcaacc | tacaggtgac | ttcaggcgaa | gtggtttcca | tcctaggccc | aagtgggtgtt | 120 |
| ggaaagacca | ccctctttaa | tctaatecgt | gggattttag | aagttcagtc | agggagaatt  | 180 |
| gtccttgatg | gtgaagaaaa | tccaagggg  | cgcgtgagtt | atatgttgca | aaaggatctg  | 240 |
| ctcttggagc | acaagacggt | gcttggaaat | atcattctgc | ccctcttgat | tcaaaagggtg | 300 |
| gataaggcag | aagctatttc | ccgagcggat | aaaattcttg | cgaccttcca | gctgacagct  | 360 |
| gtaagagaca | agtatcctca | tgaacttagc | ggtgggatgc | gccagcgtgt | agccttactc  | 420 |
| cggacctacc | tttttgggca | caagctcttt | ctcttagatg | aggcctttag | cgccttggat  | 480 |
| gagatgacaa | agatggaact | ccacgcttgg | tatcttgaga | ttcacaagca | gttgacagcta | 540 |
| acaaccctga | tcatacagca | tagtattgag | gaggccctca | atctcagcga | ccgtatctat  | 600 |
| atcttgaaaa | atcgccctgg | gcagattggt | tcagaaatta | aactagattg | gtctgaagat  | 660 |
| gaggacaagg | aagtccaaaa | gattgcctac | aaacgtcaaa | ttttggcgga | attaggctta  | 720 |
| gataagtag  |            |            |            |            |             | 729 |

<210> 72

<211> 242

<212> PRT

<213> Streptococcus pneumoniae

<400> 72

|   |
|---|
| Met Thr Glu Ile Arg Leu Glu His Val Ser Tyr Ala Tyr Gly Gln Glu |
| 1 5 10 15   |

Arg Ile Leu Glu Asp Ile Asn Leu Gln Val Thr Ser Gly Glu Val Val  
                   20                                  25                                  30  
 Ser Ile Leu Gly Pro Ser Gly Val Gly Lys Thr Thr Leu Phe Asn Leu  
                   35                                  40                                  45  
 Ile Ala Gly Ile Leu Glu Val Gln Ser Gly Arg Ile Val Leu Asp Gly  
                   50                                  55                                  60  
 Glu Glu Asn Pro Lys Gly Arg Val Ser Tyr Met Leu Gln Lys Asp Leu  
                   65                                  70                                  75                                  80  
 Leu Leu Glu His Lys Thr Val Leu Gly Asn Ile Ile Leu Pro Leu Leu  
                                   85                                  90                                  95  
 Ile Gln Lys Val Asp Lys Ala Glu Ala Ile Ser Arg Ala Asp Lys Ile  
                                   100                                  105                                  110  
 Leu Ala Thr Phe Gln Leu Thr Ala Val Arg Asp Lys Tyr Pro His Glu  
                   115                                  120                                  125  
 Leu Ser Gly Gly Met Arg Gln Arg Val Ala Leu Leu Arg Thr Tyr Leu  
                   130                                  135                                  140  
 Phe Gly His Lys Leu Phe Leu Leu Asp Glu Ala Phe Ser Ala Leu Asp  
                   145                                  150                                  155                                  160  
 Glu Met Thr Lys Met Glu Leu His Ala Trp Tyr Leu Glu Ile His Lys  
                                   165                                  170                                  175  
 Gln Leu Gln Leu Thr Thr Leu Ile Ile Thr His Ser Ile Glu Glu Ala  
                                   180                                  185                                  190  
 Leu Asn Leu Ser Asp Arg Ile Tyr Ile Leu Lys Asn Arg Pro Gly Gln  
                   195                                  200                                  205  
 Ile Val Ser Glu Ile Lys Leu Asp Trp Ser Glu Asp Glu Asp Lys Glu  
                   210                                  215                                  220  
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<210> 73

<211> 2433

<212> DNA

<213> Streptococcus pneumoniae

<400> 73

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 <213> Streptococcus pneumoniae

<400> 74  
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           20                  25                  30  
 Ile Ala Met Ser Asn His Ser Tyr Ser Val Ala Gly Ala Thr Leu Asn  
       35                  40                  45  
 Asp Tyr Pro Tyr Glu Met Asp Arg Leu Glu Glu Val Ala Leu Glu Leu  
       50                  55                  60

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Thr | Glu | Thr | Asp | Tyr | Ser | Gln | Asp | Glu | Thr | Phe | Thr | Glu | Leu | Pro | Phe |  |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |
| Ser | Arg | Arg | Leu | Gln | Val | Leu | Phe | Asp | Glu | Ala | Glu | Tyr | Val | Ala | Ser |  |
|     |     |     | 85  |     |     |     |     |     | 90  |     |     |     |     | 95  |     |  |
| Val | Val | His | Ala | Lys | Val | Leu | Gly | Thr | Glu | His | Val | Leu | Tyr | Ala | Ile |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |
| Leu | His | Asp | Ser | Asn | Ala | Leu | Ala | Thr | Arg | Ile | Leu | Glu | Arg | Ala | Gly |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |
| Phe | Ser | Tyr | Glu | Asp | Lys | Lys | Asp | Gln | Val | Lys | Ile | Ala | Ala | Leu | Arg |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |
| Arg | Asn | Leu | Glu | Glu | Arg | Ala | Gly | Trp | Thr | Arg | Glu | Asp | Leu | Lys | Ala |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |
| Leu | Arg | Gln | Arg | His | Arg | Thr | Val | Ala | Asp | Lys | Gln | Asn | Ser | Met | Ala |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |
| Asn | Met | Met | Gly | Met | Pro | Gln | Thr | Pro | Ser | Gly | Gly | Leu | Glu | Asp | Tyr |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |
| Thr | His | Asp | Leu | Thr | Glu | Gln | Ala | Arg | Ser | Gly | Lys | Leu | Glu | Pro | Val |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |
| Ile | Gly | Arg | Asp | Lys | Glu | Ile | Ser | Arg | Met | Ile | Gln | Ile | Leu | Ser | Arg |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |
| Lys | Thr | Lys | Asn | Asn | Pro | Val | Leu | Val | Gly | Asp | Ala | Gly | Val | Gly | Lys |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |
| Thr | Ala | Leu | Ala | Leu | Gly | Leu | Ala | Gln | Arg | Ile | Ala | Ser | Gly | Asp | Val |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |
| Pro | Ala | Glu | Met | Ala | Lys | Met | Arg | Val | Leu | Glu | Leu | Asp | Leu | Met | Asn |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |
| Val | Val | Ala | Gly | Thr | Arg | Phe | Arg | Gly | Asp | Phe | Glu | Glu | Arg | Met | Asn |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |
| Asn | Ile | Ile | Lys | Asp | Ile | Glu | Glu | Asp | Gly | Gln | Val | Ile | Leu | Phe | Ile |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |
| Asp | Glu | Leu | His | Thr | Ile | Met | Gly | Ser | Gly | Ser | Gly | Ile | Asp | Ser | Thr |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |
| Leu | Asp | Ala | Ala | Asn | Ile | Leu | Lys | Pro | Ala | Leu | Ala | Arg | Gly | Thr | Leu |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |  |
| Arg | Thr | Val | Gly | Ala | Thr | Thr | Gln | Glu | Glu | Tyr | Gln | Lys | His | Ile | Glu |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |
| Lys | Asp | Ala | Ala | Leu | Ser | Arg | Arg | Phe | Ala | Lys | Val | Thr | Ile | Glu | Glu |  |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |  |



Pro Ser Val Ala Asp Ser Met Thr Ile Leu Gln Gly Leu Lys Ala Thr  
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 Tyr Glu Lys His His Arg Val Gln Ile Thr Asp Glu Ala Val Glu Thr  
 385 390 395 400  
 Ala Val Lys Met Ala His Arg Tyr Leu Thr Ser Arg His Leu Pro Asp  
 405 410 415  
 Ser Ala Ile Asp Leu Leu Asp Glu Ala Ala Ala Thr Val Gln Asn Lys  
 420 425 430  
 Ala Lys His Val Lys Ala Asp Asp Ser Asp Leu Ser Pro Ala Asp Lys  
 435 440 445  
 Ala Leu Met Asp Gly Lys Trp Lys Gln Ala Ala Gln Leu Ile Ala Lys  
 450 455 460  
 Glu Glu Glu Val Pro Val Tyr Lys Asp Leu Val Thr Glu Ser Asp Ile  
 465 470 475 480  
 Leu Thr Thr Leu Ser Arg Leu Ser Gly Ile Pro Val Gln Lys Leu Thr  
 485 490 495  
 Gln Thr Asp Ala Lys Lys Tyr Leu Asn Leu Glu Ala Glu Leu His Lys  
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 Arg Val Ile Gly Gln Asp Gln Ala Val Ser Ser Ile Ser Arg Ala Ile  
 515 520 525  
 Arg Arg Asn Gln Ser Gly Ile Arg Ser His Lys Arg Pro Ile Gly Ser  
 530 535 540  
 Phe Met Phe Leu Gly Pro Thr Gly Val Gly Lys Thr Glu Leu Ala Lys  
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 Ala Leu Ala Glu Val Leu Phe Asp Asp Glu Ser Ala Leu Ile Arg Phe  
 565 570 575  
 Asp Met Ser Glu Tyr Met Glu Lys Phe Ala Ala Ser Arg Leu Asn Gly  
 580 585 590  
 Ala Pro Pro Gly Tyr Val Gly Tyr Glu Glu Gly Gly Glu Leu Thr Glu  
 595 600 605  
 Lys Val Arg Asn Lys Pro Tyr Ser Val Leu Leu Phe Asp Glu Val Glu  
 610 615 620  
 Lys Ala His Pro Asp Ile Phe Asn Val Leu Leu Gln Val Leu Asp Asp  
 625 630 635 640  
 Gly Val Leu Thr Asp Ser Lys Gly Arg Lys Val Asp Phe Ser Asn Thr  
 645 650 655  
 Ile Ile Ile Met Thr Ser Asn Leu Gly Ala Thr Ala Leu Arg Asp Asp  
 660 665 670

Lys Thr Val Gly Phe Gly Ala Lys Asp Ile Arg Phe Asp Gln Glu Asn  
 675 680 685  
 Met Glu Lys Arg Met Phe Glu Glu Leu Lys Lys Ala Tyr Arg Pro Glu  
 690 695 700  
 Phe Ile Asn Arg Ile Asp Glu Lys Val Val Phe His Ser Leu Ser Ser  
 705 710 715 720  
 Asp His Met Gln Glu Val Val Lys Ile Met Val Lys Pro Leu Val Ala  
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 Ser Leu Thr Glu Lys Gly Ile Asp Leu Lys Leu Gln Ala Ser Ala Leu  
 740 745 750  
 Lys Leu Leu Ala Asn Gln Gly Tyr Asp Pro Glu Met Gly Ala Arg Pro  
 755 760 765  
 Leu Arg Arg Thr Leu Gln Thr Glu Val Glu Asp Lys Leu Ala Glu Leu  
 770 775 780  
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<210> 75

<211> 1008

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 75

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<210> 76

<211> 335

<212> PRT

<213> Streptococcus pneumoniae

<400> 76

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| Met | Lys | Lys | Thr | Trp | Lys | Val | Phe | Leu | Thr | Leu | Val | Thr | Ala | Leu | Val |  |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |  |
| Ala | Val | Val | Leu | Val | Ala | Cys | Gly | Gln | Gly | Thr | Ala | Ser | Lys | Asp | Asn |  |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |  |
| Lys | Glu | Ala | Glu | Leu | Lys | Lys | Val | Asp | Phe | Ile | Leu | Asp | Trp | Thr | Pro |  |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |  |
| Asn | Thr | Asn | His | Thr | Gly | Leu | Tyr | Val | Ala | Lys | Glu | Lys | Gly | Tyr | Phe |  |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |  |
| Lys | Glu | Ala | Gly | Val | Asp | Val | Asp | Leu | Lys | Leu | Pro | Pro | Glu | Glu | Ser |  |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |
| Ser | Ser | Asp | Leu | Val | Ile | Asn | Gly | Lys | Ala | Pro | Phe | Ala | Val | Tyr | Phe |  |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |  |
| Gln | Asp | Tyr | Met | Ala | Lys | Lys | Leu | Glu | Lys | Gly | Ala | Gly | Ile | Thr | Ala |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |
| Val | Ala | Ala | Ile | Val | Glu | His | Asn | Thr | Ser | Gly | Ile | Ile | Ser | Arg | Lys |  |
|     |     |     | 115 |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |
| Ser | Asp | Asn | Val | Ser | Ser | Pro | Lys | Asp | Leu | Val | Gly | Lys | Lys | Tyr | Gly |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |
| Thr | Trp | Asn | Asp | Pro | Thr | Glu | Leu | Ala | Met | Leu | Lys | Thr | Leu | Val | Glu |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |
| Ser | Gln | Gly | Gly | Asp | Phe | Glu | Lys | Val | Glu | Lys | Val | Pro | Asn | Asn | Asp |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |
| Ser | Asn | Ser | Ile | Thr | Pro | Ile | Ala | Asn | Gly | Val | Phe | Asp | Thr | Ala | Trp |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |
| Ile | Tyr | Tyr | Gly | Trp | Asp | Gly | Ile | Leu | Ala | Lys | Ser | Gln | Gly | Val | Asp |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |
| Ala | Asn | Phe | Met | Tyr | Leu | Lys | Asp | Tyr | Val | Lys | Glu | Phe | Asp | Tyr | Tyr |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |
| Ser | Pro | Val | Ile | Ile | Ala | Asn | Asn | Asp | Tyr | Leu | Lys | Asp | Asn | Lys | Glu |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |
| Glu | Ala | Arg | Lys | Val | Ile | Gln | Ala | Ile | Lys | Lys | Gly | Tyr | Gln | Tyr | Ala |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |
| Met | Glu | His | Pro | Glu | Glu | Ala | Ala | Asp | Ile | Leu | Ile | Lys | Asn | Ala | Pro |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |
| Glu | Leu | Lys | Glu | Lys | Arg | Asp | Phe | Val | Ile | Glu | Ser | Gln | Lys | Tyr | Leu |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |

Ser Lys Glu Tyr Ala Ser Asp Lys Glu Lys Trp Gly Gln Phe Asp Ala  
 290 295 300

Ala Arg Trp Asn Ala Phe Tyr Lys Trp Asp Lys Glu Asn Gly Ile Leu  
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Lys Glu Asp Leu Thr Asp Lys Gly Phe Thr Asn Glu Phe Val Lys  
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<210> 77

<211> 762

<212> DNA

<213> Streptococcus pneumoniae

<400> 77

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<211> 253

<212> PRT

<213> Streptococcus pneumoniae

<400> 78

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Leu Leu Pro Lys Phe Ile Leu Pro Thr Pro Leu Glu Ile Leu Gln Pro  
 35 40 45

Phe Val Arg Asp Arg Glu Phe Leu Trp His His Ser Trp Ala Thr Leu  
 50 55 60

Arg Val Ala Leu Leu Gly Leu Ile Leu Gly Val Leu Ile Ala Cys Leu  
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Met Ala Val Leu Met Asp Ser Leu Thr Trp Leu Asn Asp Leu Ile Tyr  
 85 90 95

Pro Met Met Val Val Ile Gln Thr Ile Pro Thr Ile Ala Ile Ala Pro  
 100 105 110  
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 130 135 140  
 Phe Arg His Cys Asp Lys Asp Met Leu Thr Leu Phe Ser Leu Met Arg  
 145 150 155 160  
 Ala Lys Pro Trp Gln Ile Leu Trp His Phe Lys Ile Pro Val Ser Leu  
 165 170 175  
 Pro Tyr Phe Tyr Ala Gly Leu Arg Val Ser Val Ser Tyr Ala Phe Ile  
 180 185 190  
 Thr Thr Val Val Ser Glu Trp Leu Gly Gly Phe Glu Gly Leu Gly Val  
 195 200 205  
 Tyr Met Ile Gln Ser Lys Lys Leu Phe Gln Tyr Asp Thr Met Phe Ala  
 210 215 220  
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 225 230 235 240  
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 gaagaactcg agtttcaatt gcttaataac caaggaaaga ttaccttcca cttttcaagt 240  
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 <212> PRT  
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|   |     |    |     |    |     |
|---|-----|----|-----|----|-----|
|   | 20  |    | 25  |    | 30  |
| Ile Val Thr Ser Leu Pro Asp Asp Ile Ile Asp Ser Phe Trp Tyr Ile |     |    |     |    |     |
|   | 35  |    | 40  |    | 45  |
| Ile Asp His Phe Leu Lys Asn Val Phe Glu Leu Glu Glu Glu Leu Glu |     |    |     |    |     |
|   | 50  |    | 55  |    | 60  |
| Phe Gln Leu Leu Asn Asn Gln Gly Lys Ile Thr Phe His Phe Ser Ser |     |    |     |    |     |
|   | 65  |    | 70  |    | 75  |
| Gln His Leu Pro Thr Ala Ile Asp Phe Asp Phe Asn His Pro Phe Asp |     |    |     |    |     |
|   |     | 85 |     | 90 | 95  |
| Pro Arg Tyr Pro Pro Arg Val Leu Val Leu Asp Met Asp Gly Arg Glu |     |    |     |    |     |
|   | 100 |    | 105 |    | 110 |
| Thr Ile Leu Leu Pro Glu Glu Asn Asp Leu Phe                     |     |    |     |    |     |
|   | 115 |    | 120 |    |     |

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 <213> Streptococcus pneumoniae

<400> 81  
 acagcgggtgt cattctatct attttaagaa aagtaataat caattgttaa aaatagtaaa 60  
 aaaattggag gttctgatga aatattttgt tcctaagag gtattcagta ttcgtaaatt 120  
 aaagggtggg acttgctcgg tactattggc aatttcaatt ttgggaagcc aaggtatttt 180  
 atcggatgaa gttgttacta gttcttcacc gatggctaca aaagagtctt ctaatgcaat 240  
 tactaatgat ttagataatt caccaactgt taatcagaat cgttctgctg aaatgattgc 300  
 ctctaattca accactaatg gtttagataa ttcgttaagt gttaatagca tcagctctaa 360  
 tggactactt cgttccaatt cacaattaga caacagaaca gttgaatcta cagtaacatc 420  
 tactaatgaa aataagagtt ataaggaaga tggtataagt gacagaatta tcaaaaaaga 480  
 atttgaagat actgctttta gtgtaaaaga ttatgggtgca gtaggtgatg ggattcatga 540  
 tgatcgacaa gcaattcaag atgcaataga tgctgcagct caagggctag gtggaggaaa 600  
 tgtatatttt cctgaaggaa cttattttagt aaaagaaatt gtttttttaa aaagtcatac 660  
 acacttagaa ttgaatgaga aagctacaat tctaaatggg ataaatatta agaatcacc 720  
 ttccattggt tttatgacag gtttatttac ggatgatggg gcgcaagtag aatggggccc 780  
 aacagaagat attagttatt ctgggtggtac gattgatatg aacggtgctt tgaatgaaga 840  
 aggaactaaa gcaaaaaatc taccacttat aaattcttca ggtgcatttg ctattgggaa 900  
 ttcaaataac gtaactataa aaaatgtaac attcaaggat agttatcaag ggcatgctat 960  
 tcaaattgca gggttcgaaa atgtattagt tgataattct cgttttcttg ggcaagcctt 1020  
 acccaaaacg atgaaggatg ggcaaactat aagtaaggag agcattcaga ttgaaccatt 1080  
 aactagaaaa gggttttcctt atgccttgaa tgatgatggg aaaaaatctg aaaatgtgac 1140  
 tattcaaaat tcctattttg gcaaaagtga taaatctggg gaattagtaa cagcaattgg 1200  
 cacacactat caaacattgt cgacacagaa cccctctaatt attaaaattc aaaataatca 1260  
 ttttgataac atagtgtatg caggtgtacg ttttacagga ttactgatg tattaatcaa 1320  
 aggaaatcgc tttgataaga aagttaaagg agagagtgtg cattatcgag aaagcggagc 1380  
 agcttttagta aatgcttata gctataaaaa cactaaagac ctattagatt taaataaaca 1440  
 ggtggttatc gccgaaaata tatttaatat tgccgatcct aaaacaaaag cgatacgagt 1500  
 tgcaaaagat agtgcagaat gtttaggaaa agtatcagat attactgtaa caaaaaatgt 1560  
 aattaataat aattctaagg aaacagaaca accaaatatt gaattattac gagttagtga 1620  
 taatttagta gtctcagaga atagt 1645

<210> 82

<211> 548

<212> PRT

<213> Streptococcus pneumoniae

<400> 82

Gln Arg Cys His Ser Ile Tyr Phe Lys Lys Ser Asn Asn Gln Leu Leu  
1 5 10 15

Lys Ile Val Lys Lys Leu Glu Val Leu Met Lys Tyr Phe Val Pro Asn  
20 25 30

Glu Val Phe Ser Ile Arg Lys Leu Lys Val Gly Thr Cys Ser Val Leu  
35 40 45

Leu Ala Ile Ser Ile Leu Gly Ser Gln Gly Ile Leu Ser Asp Glu Val  
50 55 60

Val Thr Ser Ser Ser Pro Met Ala Thr Lys Glu Ser Ser Asn Ala Ile  
65 70 75 80

Thr Asn Asp Leu Asp Asn Ser Pro Thr Val Asn Gln Asn Arg Ser Ala  
85 90 95

Glu Met Ile Ala Ser Asn Ser Thr Thr Asn Gly Leu Asp Asn Ser Leu  
100 105 110

Ser Val Asn Ser Ile Ser Ser Asn Gly Thr Ile Arg Ser Asn Ser Gln  
115 120 125

Leu Asp Asn Arg Thr Val Glu Ser Thr Val Thr Ser Thr Asn Glu Asn  
130 135 140

Lys Ser Tyr Lys Glu Asp Val Ile Ser Asp Arg Ile Ile Lys Lys Glu  
145 150 155 160

Phe Glu Asp Thr Ala Leu Ser Val Lys Asp Tyr Gly Ala Val Gly Asp  
165 170 175

Gly Ile His Asp Asp Arg Gln Ala Ile Gln Asp Ala Ile Asp Ala Ala  
180 185 190

Ala Gln Gly Leu Gly Gly Gly Asn Val Tyr Phe Pro Glu Gly Thr Tyr  
195 200 205

Leu Val Lys Glu Ile Val Phe Leu Lys Ser His Thr His Leu Glu Leu  
210 215 220

Asn Glu Lys Ala Thr Ile Leu Asn Gly Ile Asn Ile Lys Asn His Pro  
225 230 235 240

Ser Ile Val Phe Met Thr Gly Leu Phe Thr Asp Asp Gly Ala Gln Val  
245 250 255

Glu Trp Gly Pro Thr Glu Asp Ile Ser Tyr Ser Gly Gly Thr Ile Asp  
260 265 270

[illegible]



<210> 83  
 <211> 324  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 83  
 gtgatgaaag aaactcagct attaaaaggt gttcttgaag gttgtgtctt ggatatgatt 60  
 ggtcaaaaag agcggatatg ttatgagttg gttcagactt tgcgagaggc tggatttgat 120  
 actatcgttc caggaactat ttatcctttg ttgcaaaagt tagaaaaaaa tcaatggata 180  
 agaggcgaca tgcgcccgtc gccagatggg ccagatcgga agtatttttc attaatgaaa 240  
 gaaggagaag agcgtgtctc agtccttttg caacaatggg acgatttgag tcaaaaagta 300  
 gaagggatta agaatggggg ttaa 324

<210> 84  
 <211> 107  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 84  
 Met Met Lys Glu Thr Gln Leu Leu Lys Gly Val Leu Glu Gly Cys Val  
     1                    5                    10                    15  
 Leu Asp Met Ile Gly Gln Lys Glu Arg Tyr Gly Tyr Glu Leu Val Gln  
                     20                    25                    30  
 Thr Leu Arg Glu Ala Gly Phe Asp Thr Ile Val Pro Gly Thr Ile Tyr  
             35                    40                    45  
 Pro Leu Leu Gln Lys Leu Glu Lys Asn Gln Trp Ile Arg Gly Asp Met  
     50                    55                    60  
 Arg Pro Ser Pro Asp Gly Pro Asp Arg Lys Tyr Phe Ser Leu Met Lys  
     65                    70                    75                    80  
 Glu Gly Glu Glu Arg Val Ser Val Phe Trp Gln Gln Trp Asp Asp Leu  
                     85                    90                    95  
 Ser Gln Lys Val Glu Gly Ile Lys Asn Gly Gly  
     100                    105

<210> 85  
 <211> 816  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 85  
 atgaagaaaa tgaagtatta cgaagaaaca agcgctttgc tacatgagtt ttctgaggag 60  
 aatcaaaaag attttgagga gttgtgggaa agttttaatc ttgctggatt tctctatgat 120  
 gaagactatc tcagagagca gatctatttg atgatgctag atttctcaga agcagaacga 180  
 gatggcatga gtgcagagga ttatctaggt aagaatccta aaaaaataat gaaagagatt 240  
 ctcaagggag cacctcgag ttctatcaaa gagtcctttt tgacgccaat tcttgtcctg 300  
 gcggtattac gttattatca actactaagt gatttttcta aaggtcctct cttaacagtc 360  
 aatttgctca catttttagg gcaacttctt atttttctga ttggatttg acttgtggcc 420  
 acaattttac gaagaagttt agtccaagat tctcctaaaa tgaaaattgg cacttacatt 480

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gttggtggga ctatagttct tctagttggt ttaggatatg taggaatggc aagcttcata 540
caagaaggag ccttttatat tccggctccc tgggatagtt tgtctgtctt tacgatttcg 600
ctagttatcg gtatttgga ttggaaagaa gcggtctttc gtccatttgt cagtatgatt 660
attgcccatc ttgtggtggg ttctctgctc cgttattatg agtggatggg aatttcaa 720
gttttcctta caaaagtat tccttttagct gtcctcttta ttggaatctt tgtcttggtc 780
cgtgggttta agaagataaa atggagtga gtatag 816

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<210> 86

<211> 271

<212> PRT

<213> Streptococcus pneumoniae

<400> 86

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Met Lys Lys Met Lys Tyr Tyr Glu Glu Thr Ser Ala Leu Leu His Glu
  1          5          10      /          15

Phe Ser Glu Glu Asn Gln Lys Tyr Phe Glu Glu Leu Trp Glu Ser Phe
      20          25          30

Asn Leu Ala Gly Phe Leu Tyr Asp Glu Asp Tyr Leu Arg Glu Gln Ile
      35          40          45

Tyr Leu Met Met Leu Asp Phe Ser Glu Ala Glu Arg Asp Gly Met Ser
      50          55          60

Ala Glu Asp Tyr Leu Gly Lys Asn Pro Lys Lys Ile Met Lys Glu Ile
      65          70          75          80

Leu Lys Gly Ala Pro Arg Ser Ser Ile Lys Glu Ser Leu Leu Thr Pro
      85          90          95

Ile Leu Val Leu Ala Val Leu Arg Tyr Tyr Gln Leu Leu Ser Asp Phe
      100          105          110

Ser Lys Gly Pro Leu Leu Thr Val Asn Leu Leu Thr Phe Leu Gly Gln
      115          120          125

Leu Leu Ile Phe Leu Ile Gly Phe Gly Leu Val Ala Thr Ile Leu Arg
      130          135          140

Arg Ser Leu Val Gln Asp Ser Pro Lys Met Lys Ile Gly Thr Tyr Ile
      145          150          155          160

Val Val Gly Thr Ile Val Leu Leu Val Val Leu Gly Tyr Val Gly Met
      165          170          175

Ala Ser Phe Ile Gln Glu Gly Ala Phe Tyr Ile Pro Ala Pro Trp Asp
      180          185          190

Ser Leu Ser Val Phe Thr Ile Ser Leu Val Ile Gly Ile Trp Asn Trp
      195          200          205

Lys Glu Ala Val Phe Arg Pro Phe Val Ser Met Ile Ile Ala His Leu
      210          215          220

Val Val Gly Ser Leu Leu Arg Tyr Tyr Glu Trp Met Gly Ile Ser Asn

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 225 |     | 230 |     | 235 |     | 240 |     |     |     |     |     |     |     |     |     |
| Val | Phe | Leu | Thr | Lys | Val | Ile | Pro | Leu | Ala | Val | Leu | Phe | Ile | Gly | Ile |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |
| Phe | Val | Leu | Phe | Arg | Gly | Phe | Lys | Lys | Ile | Lys | Trp | Ser | Glu | Val |     |
|     |     |     |     | 260 |     |     |     | 265 |     |     |     |     | 270 |     |     |

<210> 87  
 <211> 348  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 87  
 ctgtttttttt atttatactc aatgaaaatc aaagagcaaa ctaggaagct agccgcaggt 60  
 tgctcaaaac actgttttga gggtgtagac gaaactgacg aagtcagctc aaaacatggt 120  
 tttgagggtg tagatgaaac tgacgaagtc agctcaaaac actgttttga gggtgtagat 180  
 gaaactgacg aagtcagctc aaaacactgt tttgagggtg tagatgaaac tgacgaagtc 240  
 agctcaaaac atgttttttga gggtgtagat gaaactgacg aagtcagtaa ccatacatat 300  
 ggtagggcga cgctgacgtg gtttgaagag attttcgaag agtatttaa 348

<210> 88  
 <211> 115  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 88  
 Met Phe Phe Tyr Leu Tyr Ser Met Lys Ile Lys Glu Gln Thr Arg Lys  
 1 5 10 15  
 Leu Ala Ala Gly Cys Ser Lys His Cys Phe Glu Val Val Asp Glu Thr  
 20 25 30  
 Asp Glu Val Ser Ser Lys His Val Phe Glu Val Val Asp Glu Thr Asp  
 35 40 45  
 Glu Val Ser Ser Lys His Cys Phe Glu Val Val Asp Glu Thr Asp Glu  
 50 55 60  
 Val Ser Ser Lys His Cys Phe Glu Val Val Asp Glu Thr Asp Glu Val  
 65 70 75 80  
 Ser Ser Lys His Val Phe Glu Val Val Asp Glu Thr Asp Glu Val Ser  
 85 90 95  
 Asn His Thr Tyr Gly Arg Ala Thr Leu Thr Trp Phe Glu Glu Ile Phe  
 100 105 110  
 Glu Glu Tyr  
 115

<210> 89

<211> 1260

<212> DNA

<213> Streptococcus pneumoniae

<400> 89

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atgcagaatc tgaaatttgc cttttcatct atcatggctc acaagatgcg ttctttgctt 60
actatgattg ggattattat cgggtgttca tcagttgttg tgattatggc tttgggtgat 120
tccctatctc gtcaagtcaa taaagatatg actaaatctc agaaaaatat tagcgtcttt 180
ttctctccta aaaaaagtaa agacgggtct tttactcaga aacaatcagc ttttacggtt 240
tctggaaagg aagaggaagt tcctgttgaa cgcgcaaaac cgcaagaatc ctgggtccaa 300
gaggcagcta aactgaaggg agtggatagt tactatgtaa ccaattcaac gaatgccatc 360
ttgacctatc aagataaaaa gggtgagaat gctaatttga caggtggaaa cagaacttac 420
atggacgctg ttaagaatga aattattgca ggtcgtagtc tgagagagca agatttcaaa 480
gagtttgcaa gtgtcatttt gctagatgag gaattgtcca ttagtttatt tgaatctcct 540
caagaggcta ttaacaaggc tgtagaagtc aatggattta gttaccgggt cattgggggt 600
tatactagtc cggaggctaa aagatcaaaa atatatgggt ttggtggctt gcctattact 660
accaatatct cccttgctgc gaattttaat gtagatgaaa tagctaatat tgtctttcga 720
gtgaatgata ccagtttaac cccaactctg ggtccagaac tggcacgaaa aatgacagag 780
cttgaggctt tacaacaggg agaataccag gtggcagatg agtccgttgt attgcagaa 840
attcaacaat cgttttagttt tatgacgacg attattagtt ccatcgcagg gatttctctc 900
tttggtggag gaactggtgt catgaacatc atgctggttt cggtgacaga gcgcactcgt 960
gagattggtc ttcgtaaggc tttgggtgca acacgtgcca atattttaat tcagtttttg 1020
attgaatcca tgattttgac cttgttaggt ggcttaattg gcttgacaat tgcaagtggg 1080
ttaactgcct tagcagggtt gttactgcaa ggtttaatag aaggtataga agttggagta 1140
tcaatcccag tcgccctatt tagtcttgca gtttcggcta gtgttggtat gatttttgga 1200
gtcttgccag ccaacaaggc atcgaaactt gatccaattg aagcccttcg ttatgaatga 1260
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<210> 90

<211> 419

<212> PRT

<213> Streptococcus pneumoniae

<400> 90

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Met Gln Asn Leu Lys Phe Ala Phe Ser Ser Ile Met Ala His Lys Met
  1              5              10              15

Arg Ser Leu Leu Thr Met Ile Gly Ile Ile Ile Gly Val Ser Ser Val
      20              25              30

Val Val Ile Met Ala Leu Gly Asp Ser Leu Ser Arg Gln Val Asn Lys
      35              40              45

Asp Met Thr Lys Ser Gln Lys Asn Ile Ser Val Phe Phe Ser Pro Lys
      50              55              60

Lys Ser Lys Asp Gly Ser Phe Thr Gln Lys Gln Ser Ala Phe Thr Val
      65              70              75              80

Ser Gly Lys Glu Glu Glu Val Pro Val Glu Pro Pro Lys Pro Gln Glu
      85              90              95

Ser Trp Val Gln Glu Ala Ala Lys Leu Lys Gly Val Asp Ser Tyr Tyr
      100             105             110

Val Thr Asn Ser Thr Asn Ala Ile Leu Thr Tyr Gln Asp Lys Lys Val
      115             120             125
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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Glu | Asn | Ala | Asn | Leu | Thr | Gly | Gly | Asn | Arg | Thr | Tyr | Met | Asp | Ala | Val | 130 | 135 | 140 |
| Lys | Asn | Glu | Ile | Ile | Ala | Gly | Arg | Ser | Leu | Arg | Glu | Gln | Asp | Phe | Lys | 145 | 150 | 155 |
| Glu | Phe | Ala | Ser | Val | Ile | Leu | Leu | Asp | Glu | Glu | Leu | Ser | Ile | Ser | Leu | 165 | 170 | 175 |
| Phe | Glu | Ser | Pro | Gln | Glu | Ala | Ile | Asn | Lys | Val | Val | Glu | Val | Asn | Gly | 180 | 185 | 190 |
| Phe | Ser | Tyr | Arg | Val | Ile | Gly | Val | Tyr | Thr | Ser | Pro | Glu | Ala | Lys | Arg | 195 | 200 | 205 |
| Ser | Lys | Ile | Tyr | Gly | Phe | Gly | Gly | Leu | Pro | Ile | Thr | Thr | Asn | Ile | Ser | 210 | 215 | 220 |
| Leu | Ala | Ala | Asn | Phe | Asn | Val | Asp | Glu | Ile | Ala | Asn | Ile | Val | Phe | Arg | 225 | 230 | 235 |
| Val | Asn | Asp | Thr | Ser | Leu | Thr | Pro | Thr | Leu | Gly | Pro | Glu | Leu | Ala | Arg | 245 | 250 | 255 |
| Lys | Met | Thr | Glu | Leu | Ala | Gly | Leu | Gln | Gln | Gly | Glu | Tyr | Gln | Val | Ala | 260 | 265 | 270 |
| Asp | Glu | Ser | Val | Val | Phe | Ala | Glu | Ile | Gln | Gln | Ser | Phe | Ser | Phe | Met | 275 | 280 | 285 |
| Thr | Thr | Ile | Ile | Ser | Ser | Ile | Ala | Gly | Ile | Ser | Leu | Phe | Val | Gly | Gly | 290 | 295 | 300 |
| Thr | Gly | Val | Met | Asn | Ile | Met | Leu | Val | Ser | Val | Thr | Glu | Arg | Thr | Arg | 305 | 310 | 315 |
| Glu | Ile | Gly | Leu | Arg | Lys | Ala | Leu | Gly | Ala | Thr | Arg | Ala | Asn | Ile | Leu | 325 | 330 | 335 |
| Ile | Gln | Phe | Leu | Ile | Glu | Ser | Met | Ile | Leu | Thr | Leu | Leu | Gly | Gly | Leu | 340 | 345 | 350 |
| Ile | Gly | Leu | Thr | Ile | Ala | Ser | Gly | Leu | Thr | Ala | Leu | Ala | Gly | Leu | Leu | 355 | 360 | 365 |
| Leu | Gln | Gly | Leu | Ile | Glu | Gly | Ile | Glu | Val | Gly | Val | Ser | Ile | Pro | Val | 370 | 375 | 380 |
| Ala | Leu | Phe | Ser | Leu | Ala | Val | Ser | Ala | Ser | Val | Gly | Met | Ile | Phe | Gly | 385 | 390 | 395 |
| Val | Leu | Pro | Ala | Asn | Lys | Ala | Ser | Lys | Leu | Asp | Pro | Ile | Glu | Ala | Leu | 405 | 410 | 415 |
| Arg | Tyr | Glu |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

<210> 91  
 <211> 705  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 91  
 ctgatgaagc aactaattag tctaaaaaat atcttcagaa gttaccgtaa tgggtgaccaa 60  
 gaactgcagg ttctcaaaaa tatcaatcta gaagtgaatg aggggtgaatt tgtagccatc 120  
 atgggaccat ctgggtcttg taagtccact ctgatgaata cgattggcat gttggataca 180  
 ccaaccagtg gagaatatta tcttgaaggt caagaagtgg ctgggcttgg tgaaaaacaa 240  
 ctagctaagg tccgtaacca acaaatcggt tttgtctttc agcagttctt tcttctatcg 300  
 aagctcaatg ctctgcaaaa tgtagaattg cccttgattt acgcaggagt ttcgtcttca 360  
 aaacgtcgca agttggctga ggaatattta gacaagggtg aattgacaga acgtagtcac 420  
 catttacctt cagaattatc tgggtggctcaa aagcaacgtg tagccattgc gcgtgccttg 480  
 gtaaacaaatc cttctattat cctagcggat gaaccgacag gagccttgga taccaaaaca 540  
 ggtaacaaaa ttatgcaatt attggttgat ttgaataaag aaggaaaaac cattatcatg 600  
 gtaacgcatg agcctgagat tgctgcctat gccaaacgtc agattgtcat tcgggatggg 660  
 gtcatttcgt ctgacagtgc tcagttagga aaggaggaaa actaa 705

<210> 92  
 <211> 234  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 92  
 Met Met Lys Gln Leu Ile Ser Leu Lys Asn Ile Phe Arg Ser Tyr Arg  
 1 5 10 15  
 Asn Gly Asp Gln Glu Leu Gln Val Leu Lys Asn Ile Asn Leu Glu Val  
 20 25 30  
 Asn Glu Gly Glu Phe Val Ala Ile Met Gly Pro Ser Gly Ser Gly Lys  
 35 40 45  
 Ser Thr Leu Met Asn Thr Ile Gly Met Leu Asp Thr Pro Thr Ser Gly  
 50 55 60  
 Glu Tyr Tyr Leu Glu Gly Gln Glu Val Ala Gly Leu Gly Glu Lys Gln  
 65 70 75 80  
 Leu Ala Lys Val Arg Asn Gln Gln Ile Gly Phe Val Phe Gln Gln Phe  
 85 90 95  
 Phe Leu Leu Ser Lys Leu Asn Ala Leu Gln Asn Val Glu Leu Pro Leu  
 100 105 110  
 Ile Tyr Ala Gly Val Ser Ser Ser Lys Arg Arg Lys Leu Ala Glu Glu  
 115 120 125  
 Tyr Leu Asp Lys Val Glu Leu Thr Glu Arg Ser His His Leu Pro Ser  
 130 135 140  
 Glu Leu Ser Gly Gly Gln Lys Gln Arg Val Ala Ile Ala Arg Ala Leu

145                      150                      155                      160  
 Val Asn Asn Pro Ser Ile Ile Leu Ala Asp Glu Pro Thr Gly Ala Leu  
                                  165                      170                      175  
 Asp Thr Lys Thr Gly Asn Gln Ile Met Gln Leu Leu Val Asp Leu Asn  
                                  180                      185                      190  
 Lys Glu Gly Lys Thr Ile Ile Met Val Thr His Glu Pro Glu Ile Ala  
                                  195                      200                      205  
 Ala Tyr Ala Lys Arg Gln Ile Val Ile Arg Asp Gly Val Ile Ser Ser  
                                  210                      215                      220  
 Asp Ser Ala Gln Leu Gly Lys Glu Glu Asn  
 225                      230

<210> 93  
 <211> 1200  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 93  
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 ctaaaagatg agcctactca tcttggtgtt gccaaaggaag gaagcgtggc ctccctctgtt 180  
 ttattgtcag ggacagtaac agcaaaaaat gaacaatatg tttattttga tgctagtaag 240  
 ggtgatttag atgaaatcct tgtttctgtg ggcgataagg tcagcgaagg gcaggcttta 300  
 gtcaagtaca gtagttcaga agcgcaggcg gcctatgatt cagctagtcg agcagtagct 360  
 agggcagatc gtcatatcaa tgaactcaat caagcacgaa atgaagccgc ttcagctccg 420  
 gctccacagt taccagcgcc agtaggagga gaagatgcaa cggtgcaaag cccaactcca 480  
 gtggctggaa attctgttgc ttctattgac gctcaattgg gtgatgcccg tgatgcgcgt 540  
 gcagatgctg cggcgcaatt aagcaaggct caaagtcaat tggatgcaac aactgttctc 600  
 agtaccctag agggaaactgt ggtcgaaagtc aatagcaatg tttctaaatc tccaacaggg 660  
 gcgagtcaag ttatggttca tattgtcagc aatgaaaatt tacaagtcaa gggagaattg 720  
 tctgagtaca atctagccaa cttttctgta ggtcaagaag taagctttac ttctaaagtg 780  
 taccctgata aaaaatggac tgggaaatta agctatatatt ctgactatcc taaaaacaat 840  
 ggtgaagcag ctagtccagc agccgggaat aatacagggt ctaaataccc ttatactatt 900  
 gatgtgacag gcgaggttgg tgatttgaaa caagggtttt ctgtcaacat tgagggttaa 960  
 agcaaaacta aggctattct tgttcctgtt agcagtctag taatggatga tagtaaaaaat 1020  
 tatgtctgga ttgtggatga acaacaaaag gctaaaaaag ttgaggtttc attgggaaat 1080  
 gctgacgcag aaaatcaaga aatcacttct ggtttaacga acggtgctaa ggtcatcagt 1140  
 aatccaacat cttccttgga agaaggaaaa gaggtgaagg ctgatgaagc aactaattag 1200

<210> 94  
 <211> 399  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 94  
 Met Lys Lys Lys Asn Gly Lys Ala Lys Lys Trp Gln Leu Tyr Ala Ala  
   1                      5                      10                      15  
 Ile Gly Ala Ala Ser Val Val Val Leu Gly Ala Gly Gly Ile Leu Leu

| 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Phe | Arg | Gln | Pro | Ser | Gln | Thr | Ala | Leu | Lys | Asp | Glu | Pro | Thr | His | Leu |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |
| Val | Val | Ala | Lys | Glu | Gly | Ser | Val | Ala | Ser | Ser | Val | Leu | Leu | Ser | Gly |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |
| Thr | Val | Thr | Ala | Lys | Asn | Glu | Gln | Tyr | Val | Tyr | Phe | Asp | Ala | Ser | Lys |
| 65  |     |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     | 80  |
| Gly | Asp | Leu | Asp | Glu | Ile | Leu | Val | Ser | Val | Gly | Asp | Lys | Val | Ser | Glu |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |
| Gly | Gln | Ala | Leu | Val | Lys | Tyr | Ser | Ser | Ser | Glu | Ala | Gln | Ala | Ala | Tyr |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |
| Asp | Ser | Ala | Ser | Arg | Ala | Val | Ala | Arg | Ala | Asp | Arg | His | Ile | Asn | Glu |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Leu | Asn | Gln | Ala | Arg | Asn | Glu | Ala | Ala | Ser | Ala | Pro | Ala | Pro | Gln | Leu |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
| Pro | Ala | Pro | Val | Gly | Gly | Glu | Asp | Ala | Thr | Val | Gln | Ser | Pro | Thr | Pro |
| 145 |     |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     | 160 |
| Val | Ala | Gly | Asn | Ser | Val | Ala | Ser | Ile | Asp | Ala | Gln | Leu | Gly | Asp | Ala |
|     |     |     | 165 |     |     |     |     |     | 170 |     |     |     |     | 175 |     |
| Arg | Asp | Ala | Arg | Ala | Asp | Ala | Ala | Ala | Gln | Leu | Ser | Lys | Ala | Gln | Ser |
|     |     | 180 |     |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Gln | Leu | Asp | Ala | Thr | Thr | Val | Leu | Ser | Thr | Leu | Glu | Gly | Thr | Val | Val |
|     | 195 |     |     |     |     | 200 |     |     |     |     |     | 205 |     |     |     |
| Glu | Val | Asn | Ser | Asn | Val | Ser | Lys | Ser | Pro | Thr | Gly | Ala | Ser | Gln | Val |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
| Met | Val | His | Ile | Val | Ser | Asn | Glu | Asn | Leu | Gln | Val | Lys | Gly | Glu | Leu |
| 225 |     |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     | 240 |
| Ser | Glu | Tyr | Asn | Leu | Ala | Asn | Leu | Ser | Val | Gly | Gln | Glu | Val | Ser | Phe |
|     |     |     | 245 |     |     |     |     |     | 250 |     |     |     |     | 255 |     |
| Thr | Ser | Lys | Val | Tyr | Pro | Asp | Lys | Lys | Trp | Thr | Gly | Lys | Leu | Ser | Tyr |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| Ile | Ser | Asp | Tyr | Pro | Lys | Asn | Asn | Gly | Glu | Ala | Ala | Ser | Pro | Ala | Ala |
|     | 275 |     |     |     |     | 280 |     |     |     |     |     | 285 |     |     |     |
| Gly | Asn | Asn | Thr | Gly | Ser | Lys | Tyr | Pro | Tyr | Thr | Ile | Asp | Val | Thr | Gly |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |
| Glu | Val | Gly | Asp | Leu | Lys | Gln | Gly | Phe | Ser | Val | Asn | Ile | Glu | Val | Lys |
| 305 |     |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     | 320 |
| Ser | Lys | Thr | Lys | Ala | Ile | Leu | Val | Pro | Val | Ser | Ser | Leu | Val | Met | Asp |





Pro Gln Val Leu Lys Glu Ile Gly Thr Asp Tyr Val Val Ile Gly His  
                     85                    90                    95  
 Ser Glu Arg Arg Asp Tyr Phe His Glu Thr Asp Glu Asp Ile Asn Lys  
                     100                    105                    110  
 Lys Ala Lys Ala Ile Phe Ala Asn Gly Met Leu Pro Ile Ile Cys Cys  
                     115                    120                    125  
 Gly Glu Ser Leu Glu Thr Tyr Glu Ala Gly Lys Ala Ala Glu Phe Val  
                     130                    135                    140  
 Gly Ala Gln Val Ser Ala Ala Leu Ala Gly Leu Thr Ala Glu Gln Val  
                     145                    150                    155                    160  
 Ala Ala Ser Val Ile Ala Tyr Glu Pro Ile Trp Ala Ile Gly Thr Gly  
                     165                    170                    175  
 Lys Ser Ala Ser Gln Asp Asp Ala Gln Lys Met Cys Lys Val Val Arg  
                     180                    185                    190  
 Asp Val Val Ala Ala Asp Phe Gly Gln Glu Val Ala Asp Lys Val Arg  
                     195                    200                    205  
 Val Gln Tyr Gly Gly Ser Val Lys Pro Glu Asn Val Ala Ser Tyr Met  
                     210                    215                    220  
 Ala Cys Pro Asp Val Asp Gly Ala Leu Val Gly Gly Ala Ser Leu Glu  
                     225                    230                    235                    240  
 Ala Glu Ser Phe Leu Ala Leu Leu Asp Phe Val Lys  
                     245                    250

<210> 97  
 <211> 1473  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 97  
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 tcagagcaaa atcagtcttc taataaaacg caaacgagcg cagaagtaca gactaatgct 180  
 gctgcccact gggatgggga ttattatgta aaggatgatg gttctaaagc tcaaagtgaa 240  
 tggatttttg acaactacta taaggcttgg ttttatatta attcagatgg tcgttactcg 300  
 cagaatgaat ggcattgaaa ttactacctg aaatcagggtg gatatatggc ccaaaacgag 360  
 tggatctatg acagtaatta caagagttgg ttttatctca agtcagatgg ggcttatgct 420  
 catcaagaat ggcaattgat tggaaataag tgggtactact tcaagaagtg gggttacatg 480  
 gctaaaagcc aatggcaagg aagttatttc ttgaatgggc aaggagctat gatgcaaaat 540  
 gaatggctct atgatccagc ctattctgct tatttttata taaaatccga tggaaacttat 600  
 gctaaccaag agtggcaaaa agtgggcggc aaatgggtact attcaagaa gtggggcgtat 660  
 atgggtcggg atgagtggca aggcaactac tatttgactg gaagtgggtg catggcgact 720  
 gacgaagtga ttatggatgg tactcgctat atctttgcgg cctctgggtg gctcaaagaa 780  
 aaaaaagatt tgaatgtcgg ctgggttcac agagatggta agcgctatct ctttaataat 840  
 agagaagaac aagtgggaac cgaacatgct aagaaagtca ttgatattag tgagcacaat 900

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ggtcgtatca atgattggaa aaagggttatt gatgagaacg aagtggatgg tgtcattggt 960
cgtctaggtt atagcggtaa agaagacaag gaattggcgc ataacattaa ggagttaaac 1020
cgtctgggaa ttccttatgg tgtctatctc tatacctatg ctgaaaatga gaccgatgct 1080
gagagtgacg ctaaacagac cattgaactt ataaagaaat acaatatgaa cctgtcttac 1140
cctatctatt atgatgttga gaattgggaa tatgtaaata agagcaagag agctccaagt 1200
gatacaggca cttgggttaa aatcatcaac aagtacatgg acacgatgaa gcaggcgggt 1260
tatcaaaatg tgtatgtcta tagctatcgt agtttattac agacgcgttt aaaacaccca 1320
gatattttaa aacatgtaaa ctgggtagcg gcctatacga atgctttaga atgggaaaac 1380
cctcattatt caggaaaaaa aggttggcaa tatacctctt ctgaatacat gaaaggaatc 1440
caagggcgcg tagatgtcag cgtttggat taa 1473

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<210> 98

<211> 490

<212> PRT

<213> Streptococcus pneumoniae

<400> 98

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Met Lys Thr Lys Ile Gly Leu Ala Ser Ile Cys Leu Leu Gly Leu Ala
  1             5             10             15

Thr Ser His Val Ala Ala Asn Glu Thr Glu Val Ala Lys Thr Ser Gln
      20             25             30

Asp Thr Thr Thr Ala Ser Ser Ser Ser Glu Gln Asn Gln Ser Ser Asn
      35             40             45

Lys Thr Gln Thr Ser Ala Glu Val Gln Thr Asn Ala Ala Ala His Trp
      50             55             60

Asp Gly Asp Tyr Tyr Val Lys Asp Asp Gly Ser Lys Ala Gln Ser Glu
      65             70             75             80

Trp Ile Phe Asp Asn Tyr Tyr Lys Ala Trp Phe Tyr Ile Asn Ser Asp
      85             90             95

Gly Arg Tyr Ser Gln Asn Glu Trp His Gly Asn Tyr Tyr Leu Lys Ser
      100            105            110

Gly Gly Tyr Met Ala Gln Asn Glu Trp Ile Tyr Asp Ser Asn Tyr Lys
      115            120            125

Ser Trp Phe Tyr Leu Lys Ser Asp Gly Ala Tyr Ala His Gln Glu Trp
      130            135            140

Gln Leu Ile Gly Asn Lys Trp Tyr Tyr Phe Lys Lys Trp Gly Tyr Met
      145            150            155            160

Ala Lys Ser Gln Trp Gln Gly Ser Tyr Phe Leu Asn Gly Gln Gly Ala
      165            170            175

Met Met Gln Asn Glu Trp Leu Tyr Asp Pro Ala Tyr Ser Ala Tyr Phe
      180            185            190

Tyr Leu Lys Ser Asp Gly Thr Tyr Ala Asn Gln Glu Trp Gln Lys Val
      195            200            205

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Gly | Gly | Lys | Trp | Tyr | Tyr | Phe | Lys | Lys | Trp | Gly | Tyr | Met | Ala | Arg | Asn |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |
| Glu | Trp | Gln | Gly | Asn | Tyr | Tyr | Leu | Thr | Gly | Ser | Gly | Ala | Met | Ala | Thr |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |
| Asp | Glu | Val | Ile | Met | Asp | Gly | Thr | Arg | Tyr | Ile | Phe | Ala | Ala | Ser | Gly |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |
| Glu | Leu | Lys | Glu | Lys | Lys | Asp | Leu | Asn | Val | Gly | Trp | Val | His | Arg | Asp |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |
| Gly | Lys | Arg | Tyr | Phe | Phe | Asn | Asn | Arg | Glu | Glu | Gln | Val | Gly | Thr | Glu |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |
| His | Ala | Lys | Lys | Val | Ile | Asp | Ile | Ser | Glu | His | Asn | Gly | Arg | Ile | Asn |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |
| Asp | Trp | Lys | Lys | Val | Ile | Asp | Glu | Asn | Glu | Val | Asp | Gly | Val | Ile | Val |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |
| Arg | Leu | Gly | Tyr | Ser | Gly | Lys | Glu | Asp | Lys | Glu | Leu | Ala | His | Asn | Ile |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |  |
| Lys | Glu | Leu | Asn | Arg | Leu | Gly | Ile | Pro | Tyr | Gly | Val | Tyr | Leu | Tyr | Thr |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |
| Tyr | Ala | Glu | Asn | Glu | Thr | Asp | Ala | Glu | Ser | Asp | Ala | Lys | Gln | Thr | Ile |  |
|     | 355 |     |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |  |
| Glu | Leu | Ile | Lys | Lys | Tyr | Asn | Met | Asn | Leu | Ser | Tyr | Pro | Ile | Tyr | Tyr |  |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |  |
| Asp | Val | Glu | Asn | Trp | Glu | Tyr | Val | Asn | Lys | Ser | Lys | Arg | Ala | Pro | Ser |  |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |  |
| Asp | Thr | Gly | Thr | Trp | Val | Lys | Ile | Ile | Asn | Lys | Tyr | Met | Asp | Thr | Met |  |
|     |     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |  |
| Lys | Gln | Ala | Gly | Tyr | Gln | Asn | Val | Tyr | Val | Tyr | Ser | Tyr | Arg | Ser | Leu |  |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |     |  |
| Leu | Gln | Thr | Arg | Leu | Lys | His | Pro | Asp | Ile | Leu | Lys | His | Val | Asn | Trp |  |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |  |
| Val | Ala | Ala | Tyr | Thr | Asn | Ala | Leu | Glu | Trp | Glu | Asn | Pro | His | Tyr | Ser |  |
|     | 450 |     |     |     |     | 455 |     |     |     |     | 460 |     |     |     |     |  |
| Gly | Lys | Lys | Gly | Trp | Gln | Tyr | Thr | Ser | Ser | Glu | Tyr | Met | Lys | Gly | Ile |  |
| 465 |     |     |     |     | 470 |     |     |     |     | 475 |     |     |     |     | 480 |  |
| Gln | Gly | Arg | Val | Asp | Val | Ser | Val | Trp | Tyr |     |     |     |     |     |     |  |
|     |     |     |     | 485 |     |     |     |     | 490 |     |     |     |     |     |     |  |

<211> 774  
 <212> DNA  
 <213> Streptococcus pneumoniae

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 agctggactc actttgaaac catgtttgga gatgggagac tcatgctgat tttggctcag 180  
 acatttttct tggccttcct atcagccttg atagcgacca ttatcgggac ttttggtgcc 240  
 atttacatct accagtctcg taagaaatac caagaagcct ttctatcact caataaatatc 300  
 ctcatgggtg cgcctgacgt tatgattggt gctagcttct tgattctctt taccctaactc 360  
 aagttttcac ttggcttttt gaccgttcta tctagtcacg tggccttctc cattcctatc 420  
 gtggtcttga tggctcttgcc tcgactcaag gaaatgaatg gcgacatgat tcatgcggcc 480  
 tatgacttgg gagctagtca atttcagatg ttcaaggaaa tcatgcttcc ttacctgact 540  
 ccgtctatca ttactggtta ttcatggcc ttcacctatt cgttagatga ctttgccgtg 600  
 accttctttg taacaggaaa tggcttttca accctatcag tcgagattta ctctcgtgct 660  
 cgcaagggga tttccttaga aatcaatgcc ctgtctgctc tagtctttct ctttagtatt 720  
 atcctagttg taggttatta ctttatctct cgtgagaagg aggagcaagc atga 774

<210> 100  
 <211> 257  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 100  
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 20 25 30  
 Asp Met Asn Ser Phe Thr Gly Phe Ser Trp Thr His Phe Glu Thr Met  
 35 40 45  
 Phe Gly Asp Gly Arg Leu Met Leu Ile Leu Ala Gln Thr Phe Phe Leu  
 50 55 60  
 Ala Phe Leu Ser Ala Leu Ile Ala Thr Ile Ile Gly Thr Phe Gly Ala  
 65 70 75 80  
 Ile Tyr Ile Tyr Gln Ser Arg Lys Lys Tyr Gln Glu Ala Phe Leu Ser  
 85 90 95  
 Leu Asn Asn Ile Leu Met Val Ala Pro Asp Val Met Ile Gly Ala Ser  
 100 105 110  
 Phe Leu Ile Leu Phe Thr Gln Leu Lys Phe Ser Leu Gly Phe Leu Thr  
 115 120 125  
 Val Leu Ser Ser His Val Ala Phe Ser Ile Pro Ile Val Val Leu Met  
 130 135 140  
 Val Leu Pro Arg Leu Lys Glu Met Asn Gly Asp Met Ile His Ala Ala  
 145 150 155 160  
 Tyr Asp Leu Gly Ala Ser Gln Phe Gln Met Phe Lys Glu Ile Met Leu

|   |     |     |
|---|-----|-----|
| 165   | 170 | 175 |
| Pro Tyr Leu Thr Pro Ser Ile Ile Thr Gly Tyr Phe Met Ala Phe Thr |     |     |
| 180   | 185 | 190 |
| Tyr Ser Leu Asp Asp Phe Ala Val Thr Phe Phe Val Thr Gly Asn Gly |     |     |
| 195   | 200 | 205 |
| Phe Ser Thr Leu Ser Val Glu Ile Tyr Ser Arg Ala Arg Lys Gly Ile |     |     |
| 210   | 215 | 220 |
| Ser Leu Glu Ile Asn Ala Leu Ser Ala Leu Val Phe Leu Phe Ser Ile |     |     |
| 225   | 230 | 235 |
| Ile Leu Val Val Gly Tyr Tyr Phe Ile Ser Arg Glu Lys Glu Glu Gln |     |     |
| 245   | 250 | 255 |

Ala

<210> 101  
 <211> 1071  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 101

|             |            |             |            |            |            |      |
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| attgcgactc  | atttagatag | taaaatcaat  | agtcgagata | gtcaaaaatt | ggttatctat | 120  |
| aactggggag  | actatatcga | tctgaactc   | ttgactcagt | ttacagaaga | aacaggaatt | 180  |
| caagtccagt  | acgagacttt | tgactccaac  | gaagccatgt | acactaagat | aaagcagggt | 240  |
| ggaacgacct  | acgatattgc | cattccaagt  | gaatacatga | ttaacaagat | gaaggacgaa | 300  |
| gacctcttgg  | ttccgcttga | ttattcaaaa  | attgaaggaa | tcgaaaatat | cggaccagag | 360  |
| tttctcaacc  | agtcctttga | cccaggtaat  | aaattctcca | tcccttactt | ctggggaacc | 420  |
| ttaggaattg  | tctacaacga | aaccatggta  | gatgaagcgc | ctgagcattg | ggatgacctt | 480  |
| tggaagccgg  | agtataagaa | ttctatcatg  | ctctttgatg | gggcgcgtga | ggtgctggga | 540  |
| ctaggactca  | attccctcgg | ctacagcctc  | aactccaagg | atctgcagca | gttggaagag | 600  |
| acagtggata  | agctctacaa | actgactcca  | aatatcaagg | ctatcgttgc | ggacgagatg | 660  |
| aagggctata  | tgattcagaa | taatgttgca  | atcggcgtga | ccttctctgg | tgaagccagc | 720  |
| caaagtgttag | aaaaaaatga | aaatctacgt  | tatgtggtac | cgacagaggc | cagcaatctt | 780  |
| tggtttgaca  | atatggtcat | tcccaaaaaca | gttaaaaacc | aaaactcagc | ctatgccttt | 840  |
| atcaacttta  | tgttgaaacc | tgaaaatgct  | ctccaaaatg | cggagtatgt | cggctattca | 900  |
| acaccaaaacc | taccagcgaa | ggaattgctc  | ccagaggaaa | caaaggaaga | taaggccttc | 960  |
| tatcccgatg  | ttgaaaccat | gaaacaccta  | gaagtttatg | agaaatttga | ccataaatgg | 1020 |
| acagggaaat  | atagcgacct | cttcctacag  | tttaaaatgt | atcggaagta | g          | 1071 |

<210> 102  
 <211> 356  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 102

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Lys | Lys | Ile | Tyr | Ser | Phe | Leu | Ala | Gly | Ile | Ala | Ala | Ile | Ile | Leu |
| 1   |     |     |     |     | 5   |     |     |     | 10  |     |     |     |     | 15  |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Val | Leu | Trp | Gly | Ile | Ala | Thr | His | Leu | Asp | Ser | Lys | Ile | Asn | Ser | Arg | 20  | 25  | 30  |     |
| Asp | Ser | Gln | Lys | Leu | Val | Ile | Tyr | Asn | Trp | Gly | Asp | Tyr | Ile | Asp | Pro | 35  | 40  | 45  |     |
| Glu | Leu | Leu | Thr | Gln | Phe | Thr | Glu | Glu | Thr | Gly | Ile | Gln | Val | Gln | Tyr | 50  | 55  | 60  |     |
| Glu | Thr | Phe | Asp | Ser | Asn | Glu | Ala | Met | Tyr | Thr | Lys | Ile | Lys | Gln | Gly | 65  | 70  | 75  | 80  |
| Gly | Thr | Thr | Tyr | Asp | Ile | Ala | Ile | Pro | Ser | Glu | Tyr | Met | Ile | Asn | Lys | 85  | 90  | 95  |     |
| Met | Lys | Asp | Glu | Asp | Leu | Leu | Val | Pro | Leu | Asp | Tyr | Ser | Lys | Ile | Glu | 100 | 105 | 110 |     |
| Gly | Ile | Glu | Asn | Ile | Gly | Pro | Glu | Phe | Leu | Asn | Gln | Ser | Phe | Asp | Pro | 115 | 120 | 125 |     |
| Gly | Asn | Lys | Phe | Ser | Ile | Pro | Tyr | Phe | Trp | Gly | Thr | Leu | Gly | Ile | Val | 130 | 135 | 140 |     |
| Tyr | Asn | Glu | Thr | Met | Val | Asp | Glu | Ala | Pro | Glu | His | Trp | Asp | Asp | Leu | 145 | 150 | 155 | 160 |
| Trp | Lys | Pro | Glu | Tyr | Lys | Asn | Ser | Ile | Met | Leu | Phe | Asp | Gly | Ala | Arg | 165 | 170 | 175 |     |
| Glu | Val | Leu | Gly | Leu | Gly | Leu | Asn | Ser | Leu | Gly | Tyr | Ser | Leu | Asn | Ser | 180 | 185 | 190 |     |
| Lys | Asp | Leu | Gln | Gln | Leu | Glu | Glu | Thr | Val | Asp | Lys | Leu | Tyr | Lys | Leu | 195 | 200 | 205 |     |
| Thr | Pro | Asn | Ile | Lys | Ala | Ile | Val | Ala | Asp | Glu | Met | Lys | Gly | Tyr | Met | 210 | 215 | 220 |     |
| Ile | Gln | Asn | Asn | Val | Ala | Ile | Gly | Val | Thr | Phe | Ser | Gly | Glu | Ala | Ser | 225 | 230 | 235 | 240 |
| Gln | Met | Leu | Glu | Lys | Asn | Glu | Asn | Leu | Arg | Tyr | Val | Val | Pro | Thr | Glu | 245 | 250 | 255 |     |
| Ala | Ser | Asn | Leu | Trp | Phe | Asp | Asn | Met | Val | Ile | Pro | Lys | Thr | Val | Lys | 260 | 265 | 270 |     |
| Asn | Gln | Asn | Ser | Ala | Tyr | Ala | Phe | Ile | Asn | Phe | Met | Leu | Lys | Pro | Glu | 275 | 280 | 285 |     |
| Asn | Ala | Leu | Gln | Asn | Ala | Glu | Tyr | Val | Gly | Tyr | Ser | Thr | Pro | Asn | Leu | 290 | 295 | 300 |     |
| Pro | Ala | Lys | Glu | Leu | Leu | Pro | Glu | Glu | Thr | Lys | Glu | Asp | Lys | Ala | Phe | 305 | 310 | 315 | 320 |

Tyr Pro Asp Val Glu Thr Met Lys His Leu Glu Val Tyr Glu Lys Phe  
 325 330 335

Asp His Lys Trp Thr Gly Lys Tyr Ser Asp Leu Phe Leu Gln Phe Lys  
 340 345 350

Met Tyr Arg Lys  
 355

<210> 103  
 <211> 1851  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 103  
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 tatattttat tttatgggct gattaatcca gcacctgttg actacattat ctatacgagt 180  
 ttggccttcc tgttctatca attgatgatt ggtttttggg ggttgaacgc gagcattagt 240  
 cgttacagca agattacgga tttcatgaaa atcttttttg gtgtgactgc tagcagtgtc 300  
 ttgtcatata gtatctgtta tgccttcttg ccactcttct ccatccgttt catcattctc 360  
 tttatcttgt tgagtacctt cttgatttta ttgccacgga ttacttggca gttaatctac 420  
 tccagacgca aaaaaggtag tggatgatgga gaacaccgtc ggaccttctt gattggtgcc 480  
 ggtgatggtg gggctctttt tatggatagt taccaacatc caaccagtga attagaactg 540  
 gtcggtatth tggataaagga ttctaagaaa aaggggtcaaa aacttgggtg tattcctggt 600  
 ttgggctctt atgacaatct gcctgaatta gccaaacgcc atcaaatacga gcgtgtcatc 660  
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|   |     |     |     |
|---|-----|-----|-----|
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| Asn Lys Gln Gln Lys Gln Val Phe Trp Gly Ile Phe Asp Ile Phe Ser | 20  | 25  | 30  |
| Met Val Val Ser Ile Ile Val Ser Tyr Ile Leu Phe Tyr Gly Leu Ile | 35  | 40  | 45  |
| Asn Pro Ala Pro Val Asp Tyr Ile Ile Tyr Thr Ser Leu Ala Phe Leu | 50  | 55  | 60  |
| Phe Tyr Gln Leu Met Ile Gly Phe Trp Gly Leu Asn Ala Ser Ile Ser | 65  | 70  | 75  |
| Arg Tyr Ser Lys Ile Thr Asp Phe Met Lys Ile Phe Phe Gly Val Thr | 85  | 90  | 95  |
| Ala Ser Ser Val Leu Ser Tyr Ser Ile Cys Tyr Ala Phe Leu Pro Leu | 100 | 105 | 110 |
| Phe Ser Ile Arg Phe Ile Ile Leu Phe Ile Leu Leu Ser Thr Phe Leu | 115 | 120 | 125 |
| Ile Leu Leu Pro Arg Ile Thr Trp Gln Leu Ile Tyr Ser Arg Arg Lys | 130 | 135 | 140 |
| Lys Gly Ser Gly Asp Gly Glu His Arg Arg Thr Phe Leu Ile Gly Ala | 145 | 150 | 155 |
| Gly Asp Gly Gly Ala Leu Phe Met Asp Ser Tyr Gln His Pro Thr Ser | 165 | 170 | 175 |
| Glu Leu Glu Leu Val Gly Ile Leu Asp Lys Asp Ser Lys Lys Lys Gly | 180 | 185 | 190 |
| Gln Lys Leu Gly Gly Ile Pro Val Leu Gly Ser Tyr Asp Asn Leu Pro | 195 | 200 | 205 |
| Glu Leu Ala Lys Arg His Gln Ile Glu Arg Val Ile Val Ala Ile Pro | 210 | 215 | 220 |
| Ser Leu Asp Pro Ser Glu Tyr Glu Arg Ile Leu Gln Met Cys Asn Lys | 225 | 230 | 235 |
| Leu Gly Val Lys Cys Tyr Lys Met Pro Lys Val Glu Thr Val Val Gln | 245 | 250 | 255 |
| Gly Leu His Gln Ala Gly Thr Gly Phe Gln Lys Ile Asp Ile Thr Asp | 260 | 265 | 270 |
| Leu Leu Gly Arg Gln Glu Ile Arg Leu Asp Glu Ser Arg Leu Gly Ala | 275 | 280 | 285 |
| Glu Leu Thr Gly Lys Thr Ile Leu Val Thr Gly Ala Gly Gly Ser Ile | 290 | 295 | 300 |
| Gly Ser Glu Ile Cys Arg Gln Val Ser Arg Phe Asn Pro Glu Arg Ile |     |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 305 |     | 310 |     | 315 |     | 320 |     |     |     |     |     |     |     |     |     |
| Val | Leu | Leu | Gly | His | Gly | Glu | Asn | Ser | Ile | Tyr | Leu | Val | Tyr | His | Glu |
|     |     |     | 325 |     |     |     |     |     | 330 |     |     |     |     | 335 |     |
| Leu | Ile | Arg | Lys | Phe | Gln | Gly | Ile | Asp | Tyr | Val | Pro | Val | Ile | Ala | Asp |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |
| Ile | Gln | Asp | Tyr | Asp | Arg | Leu | Leu | Gln | Val | Phe | Glu | Gln | Tyr | Lys | Pro |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |
| Ala | Ile | Val | Tyr | His | Ala | Ala | Ala | His | Lys | His | Val | Pro | Met | Met | Glu |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |
| Arg | Asn | Pro | Lys | Glu | Ala | Phe | Lys | Asn | Asn | Ile | Arg | Gly | Thr | Tyr | Asn |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |
| Val | Ala | Lys | Ala | Val | Asp | Glu | Ala | Lys | Val | Ser | Lys | Met | Val | Met | Ile |
|     |     |     | 405 |     |     |     |     |     | 410 |     |     |     |     | 415 |     |
| Ser | Thr | Asp | Lys | Ala | Val | Asn | Pro | Pro | Asn | Val | Met | Gly | Ala | Thr | Lys |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |     |
| Arg | Val | Ala | Glu | Leu | Ile | Val | Thr | Gly | Phe | Asn | Gln | Arg | Ser | Gln | Ser |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |
| Thr | Tyr | Cys | Ala | Val | Arg | Phe | Gly | Asn | Val | Leu | Gly | Ser | Arg | Gly | Ser |
|     | 450 |     |     |     |     | 455 |     |     |     |     | 460 |     |     |     |     |
| Val | Ile | Pro | Val | Phe | Glu | Arg | Gln | Ile | Ala | Glu | Gly | Gly | Pro | Val | Thr |
| 465 |     |     |     |     | 470 |     |     |     |     | 475 |     |     |     |     | 480 |
| Val | Thr | Asp | Phe | Arg | Met | Thr | Arg | Tyr | Phe | Met | Thr | Ile | Pro | Glu | Ala |
|     |     |     | 485 |     |     |     |     |     | 490 |     |     |     |     | 495 |     |
| Ser | Arg | Leu | Val | Ile | His | Ala | Gly | Ala | Tyr | Ala | Lys | Asp | Gly | Glu | Val |
|     |     | 500 |     |     |     |     |     | 505 |     |     |     |     | 510 |     |     |
| Phe | Ile | Leu | Asp | Met | Gly | Lys | Pro | Val | Lys | Ile | Tyr | Asp | Leu | Ala | Lys |
|     | 515 |     |     |     |     |     | 520 |     |     |     |     | 525 |     |     |     |
| Lys | Met | Val | Leu | Leu | Ser | Gly | His | Thr | Glu | Ser | Glu | Ile | Pro | Ile | Val |
|     | 530 |     |     |     |     | 535 |     |     |     |     | 540 |     |     |     |     |
| Glu | Val | Gly | Ile | Arg | Pro | Gly | Glu | Lys | Leu | Tyr | Glu | Glu | Leu | Leu | Val |
| 545 |     |     |     |     | 550 |     |     |     |     | 555 |     |     |     |     | 560 |
| Ser | Thr | Glu | Leu | Val | Asp | Asn | Gln | Val | Met | Asp | Lys | Ile | Phe | Val | Gly |
|     |     |     | 565 |     |     |     |     |     | 570 |     |     |     |     | 575 |     |
| Lys | Val | Asn | Val | Met | Pro | Leu | Glu | Ser | Ile | Asn | Gln | Lys | Ile | Gly | Glu |
|     |     | 580 |     |     |     |     |     | 585 |     |     |     |     |     | 590 |     |
| Phe | Arg | Thr | Leu | Ser | Gly | Asp | Glu | Leu | Lys | Gln | Ala | Ile | Ile | Ala | Phe |
|     | 595 |     |     |     |     |     | 600 |     |     |     |     |     | 605 |     |     |
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610

615

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| 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ala | Arg | Leu | Val | Lys | Gln | Val | Asp | Trp | Lys | Asp | Leu | Glu | Gly | Arg | Val |
|     |     | 100 |     |     |     |     | 105 |     |     |     |     |     | 110 |     |     |
| Arg | Gln | Val | Asp | His | Tyr | Asn | Arg | Phe | Gly | Ala | Cys | Phe | Ala | Thr | Thr |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Thr | Tyr | Ser | Ala | Asp | Ser | Glu | Pro | Ile | Met | Thr | Val | Tyr | Gln | Asp | Val |
|     |     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |
| Asn | Gly | Gln | Gln | Val | Leu | Leu | Glu | Asn | His | Val | Thr | Gly | Asp | Ile | Leu |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |
| Leu | Thr | Leu | Pro | Gly | Gln | Ser | Met | Arg | Tyr | Phe | Ala | Asn | Lys | Val | Glu |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |
| Phe | Ile | Thr | Phe | Phe | Leu | Gln | Asp | Leu | Glu | Ile | Asp | Thr | Ser | Gln | Leu |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Ile | Phe | Asn | Thr | Leu | Ala | Thr | Pro | Phe | Leu | Val | Ser | Phe | His | His | Pro |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| Asp | Lys | Ser | Gly | Ser | Asp | Val | Leu | Val | Trp | Gln | Glu | Pro | Leu | Tyr | Asp |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
| Ala | Ile | Pro | Gly | Asn | Met | Gln | Leu | Ile | Leu | Glu | Ser | Asp | Asn | Val | Arg |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |
| Thr | Lys | Lys | Ile | Ile | Ile | Pro | Asn | Lys | Ala | Thr | Tyr | Glu | Arg | Ala | Leu |
|     |     |     | 245 |     |     |     |     |     | 250 |     |     |     |     | 255 |     |
| Glu | Leu | Thr | Asp | Glu | Lys | Tyr | His | Asp | Gln | Phe | Val | His | Leu | Gly | Tyr |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| His | Tyr | Gln | Phe | Lys | Arg | Asp | Asn | Phe | Leu | Arg | Arg | Asp | Ala | Leu | Ile |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |
| Leu | Thr | Asn | Ser | Asp | Gln | Ile | Glu | Gln | Val | Glu | Ala | Ile | Ala | Gly | Ala |
|     |     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |
| Leu | Pro | Asp | Val | Thr | Phe | Arg | Ile | Ala | Ala | Val | Thr | Glu | Met | Ser | Ser |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |
| Lys | Leu | Leu | Asp | Met | Leu | Cys | Tyr | Pro | Asn | Val | Ala | Leu | Tyr | Gln | Asn |
|     |     |     | 325 |     |     |     |     |     | 330 |     |     |     |     | 335 |     |
| Ala | Ser | Pro | Gln | Lys | Ile | Gln | Glu | Leu | Tyr | Gln | Leu | Ser | Asp | Ile | Tyr |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |
| Leu | Asp | Ile | Asn | His | Ser | Asn | Glu | Leu | Leu | Gln | Ala | Val | Arg | Gln | Ala |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |
| Phe | Glu | His | Asn | Leu | Leu | Ile | Leu | Gly | Phe | Asn | Gln | Thr | Val | His | Asn |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |
| Arg | Leu | Tyr | Ile | Ala | Pro | Asp | His | Leu | Phe | Glu | Ser | Ser | Glu | Val | Ala |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |
| Ala | Leu | Val | Glu | Thr | Ile | Lys | Leu | Ala | Leu | Ser | Asp | Val | Asp | Gln | Met |
|     |     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |
| Arg | Gln | Ala | Leu | Gly | Lys | Gln | Gly | Gln | His | Ala | Asn | Tyr | Val | Asp | Leu |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |     |
| Val | Arg | Tyr | Gln | Glu | Thr | Met | Gln | Thr | Val | Leu | Gly | Gly |     |     |     |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |

| 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Leu | Ser | Ser | Lys | Phe | Ile | Phe | Thr | Asp | Met | Ile | Leu | Ala | Asp | Asn | Ile |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |
| Gln | His | Leu | Thr | Ala | Asn | Ile | Gly | Phe | Asp | Asp | Asn | Gln | Val | Ile | Trp |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |
| Leu | Tyr | Asn | His | Phe | Thr | Asp | Ile | Lys | Ile | Ala | Pro | Thr | Ser | Val | Thr |
|     | 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     | 80  |
| Val | Asp | Asp | Val | Leu | Ala | Tyr | Phe | Gly | Gly | Glu | Glu | Ser | His | Arg | Glu |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |
| Lys | Asn | Gly | Lys | Val | Leu | Arg | Val | Phe | Phe | Phe | Asp | Gln | Asp | Lys | Phe |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |
| Val | Thr | Cys | Tyr | Leu | Val | Asp | Glu | Asn | Lys | Asp | Leu | Val | Gln | His | Ala |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Glu | Tyr | Val | Phe | Lys | Gly | Asn | Leu | Ile | Arg | Lys | Asp | Tyr | Phe | Ser | Tyr |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
| Thr | Arg | Tyr | Cys | Ser | Glu | Tyr | Phe | Ala | Pro | Lys | Asp | Asn | Val | Ala | Val |
|     | 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     | 160 |
| Leu | Tyr | Gln | Arg | Thr | Phe | Tyr | Asn | Glu | Asp | Gly | Thr | Pro | Val | Tyr | Asp |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |
| Ile | Leu | Met | Asn | Gln | Gly | Lys | Glu | Glu | Val | Tyr | His | Phe | Lys | Asp | Lys |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Ile | Phe | Tyr | Gly | Lys | Gln | Ala | Phe | Val | Arg | Ala | Phe | Met | Lys | Ser | Leu |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| Asn | Leu | Asn | Lys | Ser | Asp | Leu | Val | Ile | Leu | Asp | Arg | Glu | Thr | Gly | Ile |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
| Gly | Gln | Val | Val | Phe | Glu | Glu | Ala | Gln | Thr | Ala | His | Leu | Ala | Val | Val |
|     | 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     | 240 |
| Val | His | Ala | Glu | His | Tyr | Ser | Glu | Asn | Ala | Thr | Asn | Glu | Asp | Tyr | Ile |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |
| Leu | Trp | Asn | Asn | Tyr | Tyr | Asp | Tyr | Gln | Phe | Thr | Asn | Ala | Asp | Lys | Val |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| Asp | Phe | Phe | Ile | Val | Ser | Thr | Asp | Arg | Gln | Asn | Glu | Val | Leu | Gln | Glu |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |
| Gln | Phe | Ala | Lys | Tyr | Thr | Gln | His | Gln | Pro | Lys | Ile | Val | Thr | Ile | Pro |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |
| Val | Gly | Ser | Ile | Asp | Ser | Leu | Thr | Asp | Ser | Ser | Gln | Gly | Arg | Lys | Pro |
|     | 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     | 320 |
| Phe | Ser | Leu | Ile | Thr | Ala | Ser | Arg | Leu | Ala | Lys | Glu | Lys | His | Ile | Asp |

|   |     |     |
|---|-----|-----|
| 325   | 330 | 335 |
| Trp Leu Val Lys Ala Val Ile Glu Ala His Lys Glu Leu Pro Glu Leu |     |     |
| 340   | 345 | 350 |
| Thr Phe Asp Ile Tyr Gly Ser Gly Gly Glu Asp Ser Leu Leu Arg Glu |     |     |
| 355   | 360 | 365 |
| Ile Ile Ala Asn His Gln Ala Glu Asp Tyr Ile Gln Leu Lys Gly His |     |     |
| 370   | 375 | 380 |
| Ala Glu Leu Ser Gln Ile Tyr Ser Gln Tyr Glu Val Tyr Leu Thr Ala |     |     |
| 385   | 390 | 395 |
| Ser Thr Ser Glu Gly Phe Gly Leu Thr Leu Met Glu Ala Ile Gly Ser |     |     |
| 405   | 410 | 415 |
| Gly Leu Pro Leu Ile Gly Phe Asp Val Pro Tyr Gly Asn Gln Thr Phe |     |     |
| 420   | 425 | 430 |
| Ile Glu Asp Gly Gln Asn Gly Tyr Leu Ile Pro Ser Ser Ser Asp His |     |     |
| 435   | 440 | 445 |
| Val Glu Asp Gln Ile Lys Gln Ala Tyr Ala Ala Lys Ile Cys Gln Leu |     |     |
| 450   | 455 | 460 |
| Tyr Gln Glu Asn Arg Leu Glu Ala Met Arg Ala Tyr Ser Tyr Gln Ile |     |     |
| 465   | 470 | 475 |
| Ala Glu Gly Phe Leu Thr Lys Glu Ile Leu Glu Lys Trp Lys Lys Thr |     |     |
| 485   | 490 | 495 |
| Val Glu Glu Val Leu His Asp                                     |     |     |
| 500   |     |     |

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<211> 2292

<212> DNA

<213> Streptococcus pneumoniae

<400> 109

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<210> 110

<211> 763

<212> PRT

<213> Streptococcus pneumoniae

<400> 110

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Arg Gln Arg Leu Ser Glu Gly Glu Ser Leu Asp Asp Ile Leu Val Glu
 20              25              30

Ala Phe Ala Val Val Arg Glu Ala Asp Lys Arg Ile Leu Gly Met Phe
 35              40              45

Pro Tyr Asp Val Gln Val Met Gly Ala Ile Val Met His Tyr Gly Asn
 50              55              60

Val Ala Glu Met Asn Thr Gly Glu Gly Lys Thr Leu Thr Ala Thr Met
 65              70              75              80

Pro Val Tyr Leu Asn Ala Phe Ser Gly Glu Gly Val Met Val Val Thr
 85              90              95

Pro Asn Glu Tyr Leu Ser Lys Arg Asp Ala Glu Glu Met Gly Gln Val
 100             105             110

Tyr Arg Phe Leu Gly Leu Thr Ile Gly Val Pro Phe Thr Glu Asp Pro
 115             120             125

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
| Lys | Lys | Glu | Met | Lys | Ala | Glu | Glu | Lys | Lys | Leu | Ile | Tyr | Ala | Ser | Asp |  |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |  |
| Ile | Ile | Tyr | Thr | Thr | Asn | Ser | Asn | Leu | Gly | Phe | Asp | Tyr | Leu | Asn | Asp |  |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |  |
| Asn | Leu | Ala | Ser | Asn | Glu | Glu | Gly | Lys | Phe | Leu | Arg | Pro | Phe | Asn | Tyr |  |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |  |
| Val | Ile | Ile | Asp | Glu | Ile | Asp | Asp | Ile | Leu | Leu | Asp | Ser | Ala | Gln | Thr |  |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |  |
| Pro | Leu | Ile | Ile | Ala | Gly | Ser | Pro | Arg | Val | Gln | Ser | Asn | Tyr | Tyr | Ala |  |  |
|     | 195 |     |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |  |
| Ile | Ile | Asp | Thr | Leu | Val | Thr | Thr | Leu | Val | Glu | Gly | Glu | Asp | Tyr | Ile |  |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |  |
| Phe | Lys | Glu | Glu | Lys | Glu | Glu | Val | Trp | Leu | Thr | Thr | Lys | Gly | Ala | Lys |  |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |  |
| Ser | Ala | Glu | Asn | Phe | Leu | Gly | Ile | Asp | Asn | Leu | Tyr | Lys | Glu | Glu | His |  |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |  |
| Ala | Ser | Phe | Ala | Arg | His | Leu | Val | Tyr | Ala | Ile | Arg | Ala | His | Lys | Leu |  |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |  |
| Phe | Thr | Lys | Asp | Lys | Asp | Tyr | Ile | Ile | Arg | Gly | Asn | Glu | Met | Val | Leu |  |  |
|     | 275 |     |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |  |
| Val | Asp | Lys | Gly | Thr | Gly | Arg | Leu | Met | Glu | Met | Thr | Lys | Leu | Gln | Gly |  |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |  |
| Gly | Leu | His | Gln | Ala | Ile | Glu | Ala | Lys | Glu | His | Val | Lys | Leu | Ser | Pro |  |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |  |
| Glu | Thr | Arg | Ala | Met | Ala | Ser | Ile | Thr | Tyr | Gln | Ser | Leu | Phe | Lys | Met |  |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |  |  |
| Phe | Asn | Lys | Ile | Ser | Gly | Met | Thr | Gly | Thr | Gly | Lys | Val | Ala | Glu | Lys |  |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |  |
| Glu | Phe | Ile | Glu | Thr | Tyr | Asn | Met | Ser | Val | Val | Arg | Ile | Pro | Thr | Asn |  |  |
|     | 355 |     |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |  |  |
| Arg | Pro | Arg | Gln | Arg | Ile | Asp | Tyr | Pro | Asp | Asn | Leu | Tyr | Ile | Thr | Leu |  |  |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |  |  |
| Pro | Glu | Lys | Val | Tyr | Ala | Ser | Leu | Glu | Tyr | Ile | Lys | Gln | Tyr | His | Ala |  |  |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |  |  |
| Lys | Gly | Asn | Pro | Leu | Leu | Val | Phe | Val | Gly | Ser | Val | Glu | Met | Ser | Gln |  |  |
|     |     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |  |  |
| Leu | Tyr | Ser | Ser | Leu | Leu | Phe | Arg | Glu | Gly | Ile | Ala | His | Asn | Val | Leu |  |  |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |     |  |  |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Asn | Ala | Asn | Asn | Ala | Ala | Arg | Glu | Ala | Gln | Ile | Ile | Ser | Glu | Ser | Gly |
| 435 |     |     |     |     |     | 440 |     |     |     |     |     | 445 |     |     |     |
| Gln | Met | Gly | Ala | Val | Thr | Val | Ala | Thr | Ser | Met | Ala | Gly | Arg | Gly | Thr |
| 450 |     |     |     |     |     | 455 |     |     |     |     |     | 460 |     |     |     |
| Asp | Ile | Lys | Leu | Gly | Lys | Gly | Val | Ala | Glu | Leu | Gly | Gly | Leu | Ile | Val |
| 465 |     |     |     |     |     | 470 |     |     |     |     |     | 475 |     |     |     |
| Ile | Gly | Thr | Glu | Arg | Met | Glu | Ser | Gln | Arg | Ile | Asp | Leu | Gln | Ile | Arg |
|     |     |     | 485 |     |     |     |     |     | 490 |     |     |     |     |     |     |
| Gly | Arg | Ser | Gly | Arg | Gln | Gly | Asp | Pro | Gly | Met | Ser | Lys | Phe | Phe | Val |
|     |     |     | 500 |     |     |     |     |     | 505 |     |     | 510 |     |     |     |
| Ser | Leu | Glu | Asp | Asp | Val | Ile | Lys | Lys | Phe | Gly | Pro | Ser | Trp | Val | His |
|     |     |     | 515 |     |     | 520 |     |     |     |     |     | 525 |     |     |     |
| Lys | Lys | Tyr | Lys | Asp | Tyr | Gln | Val | Gln | Asp | Met | Thr | Gln | Pro | Glu | Val |
| 530 |     |     |     |     |     | 535 |     |     |     |     |     | 540 |     |     |     |
| Leu | Lys | Gly | Arg | Lys | Tyr | Arg | Lys | Leu | Val | Glu | Lys | Ala | Gln | His | Ala |
| 545 |     |     |     |     |     | 550 |     |     | 555 |     |     | 560 |     |     |     |
| Ser | Asp | Ser | Ala | Gly | Arg | Ser | Ala | Arg | Arg | Gln | Thr | Leu | Glu | Tyr | Ala |
|     |     |     | 565 |     |     |     |     |     | 570 |     |     | 575 |     |     |     |
| Glu | Ser | Met | Asn | Ile | Gln | Arg | Asp | Ile | Val | Tyr | Lys | Glu | Arg | Asn | Arg |
|     |     |     | 580 |     |     | 585 |     |     |     |     |     | 590 |     |     |     |
| Leu | Ile | Asp | Gly | Ser | Arg | Asp | Leu | Glu | Asp | Val | Val | Val | Asp | Ile | Ile |
| 595 |     |     |     |     |     | 600 |     |     |     |     |     | 605 |     |     |     |
| Glu | Arg | Tyr | Thr | Glu | Glu | Val | Ala | Ala | Asp | His | Tyr | Ala | Ser | Arg | Glu |
| 610 |     |     |     |     |     | 615 |     |     |     |     |     | 620 |     |     |     |
| Leu | Leu | Phe | His | Phe | Ile | Val | Thr | Asn | Ile | Ser | Phe | His | Val | Lys | Glu |
| 625 |     |     |     |     |     | 630 |     |     | 635 |     |     | 640 |     |     |     |
| Val | Pro | Asp | Tyr | Ile | Asp | Val | Thr | Asp | Lys | Thr | Ala | Val | Arg | Ser | Phe |
|     |     |     | 645 |     |     |     |     |     | 650 |     |     | 655 |     |     |     |
| Met | Lys | Gln | Val | Ile | Asp | Lys | Glu | Leu | Ser | Glu | Lys | Lys | Glu | Leu | Leu |
|     |     |     | 660 |     |     | 665 |     |     |     |     |     | 670 |     |     |     |
| Asn | Gln | His | Asp | Leu | Tyr | Glu | Gln | Phe | Leu | Arg | Leu | Ser | Leu | Leu | Lys |
| 675 |     |     |     |     |     | 680 |     |     |     |     |     | 685 |     |     |     |
| Ala | Ile | Asp | Asp | Asn | Trp | Val | Glu | Gln | Val | Asp | Tyr | Leu | Gln | Gln | Leu |
| 690 |     |     |     |     |     | 695 |     |     |     |     |     | 700 |     |     |     |
| Ser | Met | Ala | Ile | Gly | Gly | Gln | Ser | Ala | Ser | Gln | Lys | Asn | Pro | Ile | Val |
| 705 |     |     |     |     |     | 710 |     |     | 715 |     |     | 720 |     |     |     |
| Glu | Tyr | Tyr | Gln | Glu | Ala | Tyr | Ala | Gly | Phe | Glu | Ala | Met | Lys | Glu | Gln |
|     |     |     | 725 |     |     |     |     |     | 730 |     |     | 735 |     |     |     |

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<211> 879

<212> DNA

<213> Streptococcus pneumoniae

<400> 111

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<211> 292

<212> PRT

<213> Streptococcus pneumoniae

<400> 112

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      20           25           30

Glu Arg Ile Pro Asp Leu Asp Thr Pro Ile Glu Lys Asn Thr Gln Leu
      35           40           45

Glu Glu Glu Val Ser Gln Ala Glu Val Glu Leu Glu Ser Gln Gln Glu
      50           55           60

Glu Lys Ile Glu Ala Pro Glu Asp Ser Glu Ala Arg Thr Glu Ile Glu
      65           70           75           80

Glu Lys Lys Ala Ser Asn Ser Thr Glu Glu Glu Pro Asp Leu Ser Lys
      85           90           95

Glu Thr Glu Lys Val Thr Ile Ala Glu Glu Ser Gln Glu Ala Leu Pro
      100          105          110
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Gln Gln Lys Ala Thr Thr Lys Glu Pro Leu Leu Ile Ser Lys Ser Leu  
 115 120 125  
 Glu Ser Pro Tyr Ile Pro Asp Gln Ala Pro Lys Ser Arg Asp Lys Trp  
 130 135 140  
 Lys Glu Gln Val Leu Asp Phe Trp Ser Trp Leu Val Glu Ala Ile Lys  
 145 150 155 160  
 Ser Pro Thr Ser Lys Leu Glu Thr Ser Ile Thr His Ser Tyr Thr Ala  
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 Tyr His Ile Lys His Ala Tyr Tyr Gly His Ile Ala Ser Ile Asn Ser  
 195 200 205  
 Arg Phe Pro Glu Gln Leu Ala Pro Leu Thr Leu Phe Ser Ile Ile Ser  
 210 215 220  
 Ile Leu Val Ala Thr Thr Leu Phe Phe Phe Ser Phe Leu Leu Gly Ser  
 225 230 235 240  
 Phe Val Val Arg Arg Phe Ile His Gln Glu Lys Asp Trp Thr Leu Asp  
 245 250 255  
 Lys Val Leu Gln Gln Tyr Ser Gln Leu Leu Ala Ile Pro Ile Ser Ser  
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 Pro Ser Cys Val  
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 <211> 327  
 <212> DNA  
 <213> Streptococcus pneumoniae

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<210> 114  
 <211> 108  
 <212> PRT  
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<400> 114

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Lys Leu Ile Ala Asn Ile Lys Glu Ser Thr Leu Tyr Pro Ile Leu Lys  
35 40 45

Lys Leu Glu Gly Asn Ser Phe Leu Thr Thr Tyr Ser Arg Glu Phe Gln  
50 55 60

Gly Arg Met Arg Lys Tyr Tyr Ser Leu Thr Asn Gly Gly Ile Glu Gln  
65 70 75 80

Leu Leu Thr Leu Lys Asp Glu Trp Ala Leu Tyr Thr Asp Thr Ile Asn  
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Gly Ile Ile Glu Gly Ser Ile Arg His Asp Lys Asn  
100 105

<210> 115

<211> 954

<212> DNA

<213> Streptococcus pneumoniae

<400> 115

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<210> 116

<211> 317

<212> PRT

<213> Streptococcus pneumoniae

<400> 116

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1 5 10 15

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|
| Val | Gln | Val | Ile | Gln | Ser | Asp | Leu | Ala | Thr | Asn | Phe | Tyr | Asp | Ala | Leu |  |  |  |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |  |  |  |
| Val | Glu | Gln | Asn | Ser | Ile | Tyr | Leu | Asp | Gly | Glu | Thr | Glu | Leu | Asn | Gln |  |  |  |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |  |  |  |
| Val | Lys | Asp | Asn | Asn | Gln | Ala | Leu | Lys | Arg | Leu | Ala | Leu | Arg | Lys | Glu |  |  |  |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |  |  |  |
| Glu | Trp | Leu | Lys | Thr | Tyr | Gln | Phe | Leu | Leu | Met | Lys | Ala | Gly | Gln | Thr |  |  |  |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |  |  |
| Glu | Pro | Leu | Gln | Ala | Asn | His | Gln | Phe | Thr | Pro | Asp | Ala | Ile | Ala | Leu |  |  |  |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |  |  |  |
| Leu | Leu | Val | Phe | Ile | Val | Glu | Glu | Leu | Phe | Lys | Glu | Glu | Glu | Ile | Thr |  |  |  |
|     |     | 100 |     |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |  |  |
| Ile | Leu | Glu | Met | Gly | Ser | Gly | Met | Gly | Ile | Leu | Gly | Ala | Ile | Phe | Leu |  |  |  |
|     | 115 |     |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |  |  |
| Thr | Ser | Leu | Thr | Lys | Lys | Val | Asp | Tyr | Leu | Gly | Met | Glu | Val | Asp | Asp |  |  |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |  |  |
| Leu | Leu | Ile | Asp | Leu | Ala | Ala | Ser | Met | Ala | Asp | Val | Ile | Gly | Leu | Gln |  |  |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |  |  |
| Ala | Gly | Phe | Val | Gln | Gly | Asp | Ala | Val | Arg | Pro | Gln | Met | Leu | Lys | Glu |  |  |  |
|     |     |     | 165 |     |     |     |     |     | 170 |     |     |     | 175 |     |     |  |  |  |
| Ser | Asp | Val | Val | Ile | Ser | Asp | Leu | Pro | Val | Gly | Tyr | Tyr | Pro | Asp | Asp |  |  |  |
|     |     | 180 |     |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |  |  |
| Ala | Val | Ala | Ser | Arg | His | Gln | Val | Ala | Ser | Ser | Gln | Glu | His | Thr | Tyr |  |  |  |
|     | 195 |     |     |     |     | 200 |     |     |     |     |     | 205 |     |     |     |  |  |  |
| Ala | His | His | Leu | Leu | Met | Glu | Gln | Gly | Leu | Lys | Tyr | Leu | Lys | Ser | Asp |  |  |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |  |  |
| Gly | Tyr | Ala | Ile | Phe | Leu | Ala | Pro | Ser | Asp | Leu | Leu | Thr | Ser | Pro | Gln |  |  |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |  |  |
| Ser | Asp | Leu | Leu | Lys | Glu | Trp | Leu | Lys | Glu | Glu | Ala | Ser | Leu | Val | Ala |  |  |  |
|     |     |     | 245 |     |     |     |     |     | 250 |     |     |     |     | 255 |     |  |  |  |
| Met | Ile | Ser | Leu | Pro | Glu | Asn | Leu | Phe | Ala | Asn | Ala | Lys | Gln | Ser | Lys |  |  |  |
|     |     | 260 |     |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |  |  |
| Thr | Ile | Phe | Ile | Leu | Gln | Lys | Lys | Asn | Glu | Ile | Ala | Val | Glu | Pro | Phe |  |  |  |
|     | 275 |     |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |  |  |
| Val | Tyr | Pro | Leu | Ala | Ser | Leu | Gln | Asp | Ala | Ser | Val | Leu | Met | Lys | Phe |  |  |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |  |  |
| Lys | Glu | Asn | Phe | Gln | Lys | Trp | Thr | Gln | Gly | Thr | Glu | Ile |     |     |     |  |  |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     |     |  |  |  |

<210> 117  
 <211> 1902  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 117  
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<210> 118  
 <211> 633  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 118  
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 20 25 30  
 Ala Leu Val Gly Lys Asn Gly Ala Gly Lys Ser Thr Leu Leu Lys Ile  
 35 40 45

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|
| Leu | Val | Gly | Glu | Glu | Glu | Pro | Thr | Ser | Gly | Glu | Ile | Asn | Lys | Lys | Lys |  |  |  |
|     | 50  |     |     |     |     |     | 55  |     |     |     | 60  |     |     |     |     |  |  |  |
| Asp | Ile | Ser | Leu | Ser | Tyr | Leu | Ala | Gln | Asp | Ser | Arg | Phe | Glu | Ser | Glu |  |  |  |
|     | 65  |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |  |  |
| Asn | Thr | Ile | Tyr | Asp | Glu | Met | Leu | His | Val | Phe | Asn | Asp | Leu | Arg | Arg |  |  |  |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |  |  |  |
| Thr | Glu | Arg | Gln | Leu | Arg | Gln | Met | Glu | Leu | Glu | Met | Gly | Glu | Lys | Ser |  |  |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |  |  |
| Gly | Glu | Asp | Leu | Asp | Lys | Leu | Met | Ser | Asp | Tyr | Asp | Arg | Leu | Ser | Glu |  |  |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |  |  |
| Asn | Phe | Arg | Gln | Ala | Gly | Gly | Phe | Thr | Tyr | Glu | Ala | Asp | Ile | Arg | Ala |  |  |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |  |  |
| Ile | Leu | Asn | Gly | Phe | Lys | Phe | Asp | Glu | Ser | Met | Trp | Gln | Met | Lys | Ile |  |  |  |
|     | 145 |     |     |     | 150 |     |     |     | 155 |     |     |     |     |     | 160 |  |  |  |
| Ala | Glu | Leu | Ser | Gly | Gly | Gln | Asn | Thr | Arg | Leu | Ala | Leu | Ala | Lys | Met |  |  |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |  |  |
| Leu | Leu | Glu | Lys | Pro | Asn | Leu | Leu | Val | Leu | Asp | Glu | Pro | Thr | Asn | His |  |  |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     |     | 190 |     |  |  |  |
| Leu | Asp | Ile | Glu | Thr | Ile | Ala | Trp | Leu | Glu | Asn | Tyr | Leu | Val | Asn | Tyr |  |  |  |
|     | 195 |     |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |  |  |
| Ser | Gly | Ala | Leu | Ile | Ile | Val | Ser | His | Asp | Arg | Tyr | Phe | Leu | Asp | Lys |  |  |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |  |  |
| Val | Ala | Thr | Ile | Thr | Leu | Asp | Leu | Thr | Lys | His | Ser | Leu | Asp | Arg | Tyr |  |  |  |
|     | 225 |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |  |  |
| Val | Gly | Asn | Tyr | Ser | Arg | Phe | Val | Glu | Leu | Lys | Glu | Gln | Lys | Leu | Val |  |  |  |
|     |     |     |     | 245 |     |     |     | 250 |     |     |     |     |     | 255 |     |  |  |  |
| Thr | Glu | Ala | Lys | Asn | Tyr | Glu | Lys | Gln | Gln | Lys | Glu | Ile | Ala | Ala | Leu |  |  |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |  |  |
| Glu | Asp | Phe | Val | Asn | Arg | Asn | Leu | Val | Arg | Ala | Ser | Thr | Thr | Lys | Arg |  |  |  |
|     | 275 |     |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |  |  |
| Ala | Gln | Ser | Arg | Arg | Lys | Gln | Leu | Glu | Lys | Met | Glu | Arg | Leu | Asp | Lys |  |  |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |  |  |
| Pro | Glu | Ala | Gly | Lys | Lys | Ala | Ala | Asn | Met | Thr | Phe | Gln | Ser | Glu | Lys |  |  |  |
|     | 305 |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |  |  |
| Thr | Ser | Gly | Asn | Val | Val | Leu | Thr | Val | Glu | Asn | Ala | Ala | Val | Gly | Tyr |  |  |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |  |  |  |
| Asp | Gly | Glu | Val | Leu | Ser | Gln | Pro | Ile | Asn | Leu | Asp | Leu | Arg | Lys | Met |  |  |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |  |  |



|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Asn | Ala | Val | Ala | Ile | Val | Gly | Pro | Asn | Gly | Ile | Gly | Lys | Ser | Thr | Phe | 355 | 360 | 365 |
| Ile | Lys | Ser | Ile | Val | Asp | Gln | Ile | Pro | Phe | Ile | Lys | Gly | Glu | Lys | Arg | 370 | 375 | 380 |
| Phe | Gly | Ala | Asn | Val | Glu | Val | Gly | Tyr | Tyr | Asp | Gln | Thr | Gln | Ser | Lys | 385 | 390 | 395 |
| Leu | Thr | Pro | Ser | Asn | Thr | Val | Leu | Asp | Glu | Leu | Trp | Asn | Asp | Phe | Lys | 405 | 410 | 415 |
| Leu | Thr | Pro | Glu | Val | Glu | Ile | Arg | Asn | Arg | Leu | Gly | Ala | Phe | Leu | Phe | 420 | 425 | 430 |
| Ser | Gly | Asp | Asp | Val | Lys | Lys | Ser | Val | Gly | Met | Leu | Ser | Gly | Gly | Glu | 435 | 440 | 445 |
| Lys | Ala | Arg | Leu | Leu | Leu | Ala | Lys | Leu | Ser | Met | Glu | Asn | Asn | Asn | Phe | 450 | 455 | 460 |
| Leu | Ile | Leu | Asp | Glu | Pro | Thr | Asn | His | Leu | Asp | Ile | Asp | Ser | Lys | Glu | 465 | 470 | 475 |
| Val | Leu | Glu | Asn | Ala | Leu | Ile | Asp | Phe | Asp | Gly | Thr | Leu | Leu | Phe | Val | 485 | 490 | 495 |
| Ser | His | Asp | Arg | Tyr | Phe | Ile | Asn | Arg | Val | Ala | Thr | His | Val | Leu | Glu | 500 | 505 | 510 |
| Leu | Ser | Glu | Asn | Gly | Ser | Thr | Leu | Tyr | Leu | Gly | Asp | Tyr | Asp | Tyr | Tyr | 515 | 520 | 525 |
| Val | Glu | Lys | Lys | Ala | Thr | Ala | Glu | Met | Ser | Gln | Thr | Glu | Glu | Ala | Ser | 530 | 535 | 540 |
| Thr | Ser | Asn | Gln | Ala | Lys | Glu | Ala | Ser | Pro | Val | Asn | Asp | Tyr | Gln | Ala | 545 | 550 | 555 |
| Gln | Lys | Glu | Ser | Gln | Lys | Glu | Val | Arg | Lys | Leu | Met | Arg | Gln | Ile | Glu | 565 | 570 | 575 |
| Ser | Leu | Glu | Ala | Glu | Ile | Glu | Glu | Leu | Glu | Ser | Gln | Ser | Gln | Ala | Ile | 580 | 585 | 590 |
| Ser | Glu | Gln | Met | Leu | Glu | Thr | Asn | Asp | Ala | Asp | Lys | Leu | Met | Glu | Leu | 595 | 600 | 605 |
| Gln | Ala | Glu | Leu | Asp | Lys | Ile | Ser | His | Arg | Gln | Glu | Glu | Ala | Met | Leu | 610 | 615 | 620 |
| Glu | Trp | Glu | Glu | Leu | Ser | Glu | Gln | Val |     |     |     |     |     |     |     | 625 | 630 |     |

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 <211> 1179  
 <212> DNA  
 <213> Streptococcus pneumoniae

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<210> 120  
 <211> 392  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 120  
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 35 40 45  
 Leu Val Thr Ser Ile Leu Val Asn Pro Phe Gly Gly Val Ile Ser Asp  
 50 55 60  
 Arg Phe Ser Arg Arg Lys Ile Leu Met Thr Ala Asp Leu Val Cys Gly  
 65 70 75 80  
 Ile Leu Cys Leu Ala Ile Ser Phe Ile Arg Asn Asp Ser Trp Met Ile  
 85 90 95  
 Gly Ala Leu Ile Val Ala Asn Ile Val Gln Ala Ile Ala Phe Ala Phe  
 100 105 110  
 Ser Arg Thr Ala Asn Lys Ala Ile Ile Thr Glu Val Val Glu Lys Asp  
 115 120 125

Glu Ile Val Ile Tyr Asn Ser Arg Leu Glu Leu Val Leu Gln Val Val  
 130 135 140  
 Gly Val Ser Ser Pro Val Leu Ser Phe Leu Val Leu Gln Phe Ala Ser  
 145 150 155 160  
 Leu His Met Thr Leu Leu Leu Asp Ser Leu Thr Phe Phe Ile Ala Phe  
 165 170 175  
 Val Leu Val Ala Phe Leu Pro Lys Glu Glu Ala Lys Val Gln Glu Lys  
 180 185 190  
 Lys Ala Phe Thr Gly Arg Asp Ile Phe Val Asp Ile Lys Asp Gly Leu  
 195 200 205  
 His Tyr Ile Trp His Gln Gln Glu Ile Phe Phe Leu Leu Leu Val Ala  
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 260 265 270  
 Lys Ala Asn Ile Tyr Asn Leu Leu Ile Leu Leu Ala Leu Thr Gly Val  
 275 280 285  
 Gly Val Phe Met Met Gly Leu Pro Leu Pro Thr Phe Leu Ser Phe Ser  
 290 295 300  
 Gly Asn Leu Val Cys Glu Leu Phe Met Thr Ile Phe Asn Ile His Phe  
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<210> 121  
 <211> 2466  
 <212> DNA

<213> Streptococcus pneumoniae

<400> 121

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<210> 122

<211> 821

<212> PRT

<213> Streptococcus pneumoniae

<400> 122

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Gln Gln Lys Gln Lys Asn Lys Lys Ser Ala Arg Pro Gly Lys Lys Gly

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ser | Ser | Thr | Lys | Lys | Ser | Lys | Thr | Leu | Asp | Lys | Ser | Ala | Ile | Phe | Pro |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |
| Ala | Ile | Leu | Leu | Ser | Ile | Lys | Ala | Leu | Phe | Asn | Leu | Leu | Phe | Val | Leu |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |
| Gly | Phe | Leu | Gly | Gly | Met | Leu | Gly | Ala | Gly | Ile | Ala | Leu | Gly | Tyr | Gly |
|     | 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     | 80  |
| Val | Ala | Leu | Phe | Asp | Lys | Val | Arg | Val | Pro | Gln | Thr | Glu | Glu | Leu | Val |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |
| Asn | Gln | Val | Lys | Asp | Ile | Ser | Ser | Ile | Ser | Glu | Ile | Thr | Tyr | Ser | Asp |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |
| Gly | Thr | Val | Ile | Ala | Ser | Ile | Glu | Ser | Asp | Leu | Leu | Arg | Thr | Ser | Ile |
|     | 115 |     |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |
| Ser | Ser | Glu | Gln | Ile | Ser | Glu | Asn | Leu | Lys | Lys | Ala | Ile | Ile | Ala | Thr |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |
| Glu | Asp | Glu | His | Phe | Lys | Glu | His | Lys | Gly | Val | Val | Pro | Lys | Ala | Val |
|     | 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     | 160 |
| Ile | Arg | Ala | Thr | Leu | Gly | Lys | Phe | Val | Gly | Leu | Gly | Ser | Ser | Ser | Gly |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |
| Gly | Ser | Thr | Leu | Thr | Gln | Gln | Leu | Ile | Lys | Gln | Gln | Val | Val | Gly | Asp |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Ala | Pro | Thr | Leu | Ala | Arg | Lys | Ala | Ala | Glu | Ile | Val | Asp | Ala | Leu | Ala |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| Leu | Glu | Arg | Ala | Met | Asn | Lys | Asp | Glu | Ile | Leu | Thr | Thr | Tyr | Leu | Asn |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
| Val | Ala | Pro | Phe | Gly | Arg | Asn | Asn | Lys | Gly | Gln | Asn | Ile | Ala | Gly | Ala |
|     | 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     | 240 |
| Arg | Gln | Ala | Ala | Glu | Gly | Ile | Phe | Gly | Val | Asp | Ala | Ser | Gln | Leu | Thr |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |
| Val | Pro | Gln | Ala | Ala | Phe | Leu | Ala | Gly | Leu | Pro | Gln | Ser | Pro | Ile | Thr |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| Tyr | Ser | Pro | Tyr | Glu | Asn | Thr | Gly | Glu | Leu | Lys | Ser | Asp | Glu | Asp | Leu |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |
| Glu | Ile | Gly | Leu | Arg | Arg | Ala | Lys | Ala | Val | Leu | Tyr | Ser | Met | Tyr | Arg |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |
| Thr | Gly | Ala | Leu | Ser | Lys | Asp | Glu | Tyr | Ser | Gln | Tyr | Lys | Asp | Tyr | Asp |
|     | 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     | 320 |
| Leu | Lys | Gln | Asp | Phe | Leu | Pro | Ser | Gly | Thr | Val | Thr | Gly | Ile | Ser | Arg |

|   |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|
|   | 325 |     | 330 |     | 335 |
| Asp Tyr Leu Tyr Phe Thr Thr Leu Ala Glu Ala Gln Glu Arg Met Tyr | 340 | 345 | 350 |     |     |
| Asp Tyr Leu Ala Gln Arg Asp Asn Val Ser Ala Lys Glu Leu Lys Asn | 355 | 360 | 365 |     |     |
| Glu Ala Thr Gln Lys Phe Tyr Arg Asp Leu Ala Ala Lys Glu Ile Glu | 370 | 375 | 380 |     |     |
| Asn Gly Gly Tyr Lys Ile Thr Thr Thr Ile Asp Gln Lys Ile His Ser | 385 | 390 | 395 | 400 |     |
| Ala Met Gln Ser Ala Val Ala Asp Tyr Gly Tyr Leu Leu Asp Asp Gly | 405 | 410 | 415 |     |     |
| Thr Gly Arg Val Glu Val Gly Asn Val Leu Met Asp Asn Gln Thr Gly | 420 | 425 | 430 |     |     |
| Ala Ile Leu Gly Phe Val Gly Gly Arg Asn Tyr Gln Glu Asn Gln Asn | 435 | 440 | 445 |     |     |
| Asn His Ala Phe Asp Thr Lys Arg Ser Pro Ala Ser Thr Thr Lys Pro | 450 | 455 | 460 |     |     |
| Leu Leu Ala Tyr Gly Ile Ala Ile Asp Gln Gly Leu Met Gly Ser Glu | 465 | 470 | 475 | 480 |     |
| Thr Ile Leu Ser Asn Tyr Pro Thr Asn Phe Ala Asn Gly Asn Pro Ile | 485 | 490 | 495 |     |     |
| Met Tyr Ala Asn Ser Lys Gly Thr Gly Met Met Thr Leu Gly Glu Ala | 500 | 505 | 510 |     |     |
| Leu Asn Tyr Ser Trp Asn Ile Pro Ala Tyr Trp Thr Tyr Arg Met Leu | 515 | 520 | 525 |     |     |
| Arg Glu Lys Gly Val Asp Val Lys Gly Tyr Met Glu Lys Met Gly Tyr | 530 | 535 | 540 |     |     |
| Glu Ile Pro Glu Tyr Gly Ile Glu Ser Leu Pro Met Gly Gly Gly Ile | 545 | 550 | 555 | 560 |     |
| Glu Val Thr Val Ala Gln His Thr Asn Gly Tyr Gln Thr Leu Ala Asn | 565 | 570 | 575 |     |     |
| Asn Gly Val Tyr His Gln Lys His Val Ile Ser Lys Ile Glu Ala Ala | 580 | 585 | 590 |     |     |
| Asp Gly Arg Val Val Tyr Glu Tyr Gln Asp Lys Pro Val Gln Val Tyr | 595 | 600 | 605 |     |     |
| Ser Lys Ala Thr Ala Thr Ile Met Gln Gly Leu Leu Arg Glu Val Leu | 610 | 615 | 620 |     |     |
| Ser Ser Arg Val Thr Thr Thr Phe Lys Ser Asn Leu Thr Ser Leu Asn |     |     |     |     |     |

|   |     |     |  |     |  |     |
|---|-----|-----|--|-----|--|-----|
| 625   |     | 630 |  | 635 |  | 640 |
| Pro Thr Leu Ala Asn Ala Asp Trp Ile Gly Lys Thr Gly Thr Thr Asn |     |     |  |     |  |     |
|   | 645 |     |  | 650 |  | 655 |
| Gln Asp Glu Asn Met Trp Leu Met Leu Ser Thr Pro Arg Leu Thr Leu |     |     |  |     |  |     |
|   | 660 |     |  | 665 |  | 670 |
| Gly Gly Trp Ile Gly His Asp Asp Asn His Ser Leu Ser Arg Arg Ala |     |     |  |     |  |     |
|   | 675 |     |  | 680 |  | 685 |
| Gly Tyr Ser Asn Asn Ser Asn Tyr Met Ala His Leu Val Asn Ala Ile |     |     |  |     |  |     |
|   | 690 |     |  | 695 |  | 700 |
| Gln Gln Ala Ser Pro Ser Ile Trp Gly Asn Glu Arg Phe Ala Leu Asp |     |     |  |     |  |     |
| 705   |     | 710 |  | 715 |  | 720 |
| Pro Ser Val Val Lys Ser Glu Val Leu Lys Ser Thr Gly Gln Lys Pro |     |     |  |     |  |     |
|   | 725 |     |  | 730 |  | 735 |
| Glu Lys Val Ser Val Glu Gly Lys Glu Val Glu Val Thr Gly Ser Thr |     |     |  |     |  |     |
|   | 740 |     |  | 745 |  | 750 |
| Val Thr Ser Tyr Trp Ala Asn Lys Ser Gly Ala Pro Ala Thr Ser Tyr |     |     |  |     |  |     |
|   | 755 |     |  | 760 |  | 765 |
| Arg Phe Ala Ile Gly Gly Ser Asp Ala Asp Tyr Gln Asn Ala Trp Ser |     |     |  |     |  |     |
|   | 770 |     |  | 775 |  | 780 |
| Ser Ile Val Gly Ser Leu Pro Thr Pro Ser Ser Ser Ser Ser Ser     |     |     |  |     |  |     |
| 785   |     | 790 |  | 795 |  | 800 |
| Ser Ser Ser Ser Asp Ser Ser Asn Ser Ser Thr Thr Arg Pro Ser Ser |     |     |  |     |  |     |
|   | 805 |     |  | 810 |  | 815 |
| Ser Arg Ala Arg Arg   |     |     |  |     |  |     |
|   | 820 |     |  |     |  |     |

<210> 123  
 <211> 1974  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 123  
 atgaaaaaat tttatgtaag tccaattttt cctattctag taggattgat tgcgttttga 60  
 gtcttatcca ctttcattat ttttgtaaat aataatctgt tgacggtttt aattttgttt 120  
 cttttttag taggctatgt ttttttattt aagaaactga gaggcatta tacaaggagt 180  
 gatgtagaac agatacagta tgtaaaccac caagcggaag aaagtttgac agctctattg 240  
 gaacagatgc ctgtaggtgt tatgaaattg aatttatctt ctggagaggt tgagtgggtt 300  
 aatccctatg ctgaattgat tttgaccaag gaagatgggtg attttgattt agaagctgtt 360  
 caaacgatta tcaaggcttc agtaggaaat ccgtctactt atgccaagct tgggtgagaag 420  
 cgttatgctg ttcatatgga tgcttcttcc ggtgttttgt atttttaga tgtatccagg 480  
 gaacaagcca taacagatga attggtaaca agtagaccag tgattgggat tgtctctgtg 540  
 gataattatg atgatttgga ggatgaaact tctgagtcag atattagtca aatcaatagt 600  
 tttgtagcta atttttatatc agagttttca gaaaaacaca tgatgttttc tcgtcgggta 660

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agtatggatc gattttatct atttactgac tacacgggtgc ttgagggcctt gatgaatgat 720
aaattttctg ttattgatgc tttcagagaa gagtcgaaac agagacagtt gcccttgacc 780
ttaagtatgg gattttctta tggcgatgga aatcatgatg agatagggaa agttgctttg 840
ctcaatttga acttggctga agtacgtggt ggcgaccagg tggttgttaa ggaaaacgac 900
gaaacgaaaa atccagttta ttttgggtgt gggctctgctg cttcaatcaa gcgtacacgg 960
actcgtacgc gcgctatgat gacagctatt tcagataaga ttcggagtgt agatcagggt 1020
tttgtagtcg gtcacaaaaa tttagacatg gatgctttgg gctctgctgt aggtatgcag 1080
ttgttcgcca gcaatgtgat tgaaaatagc tatgctcttt atgatgaaga acaaatgtct 1140
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gttaaggatg caatggggat ggtgaccaat cgttctttgt tgattcttgt agaccattca 1260
aagacagcct taacattatc aaaagaatth tatgatttat ttacccaaac cattgttatt 1320
gaccaccata gaagggatca ggattttcca gataatgcgg ttattactta ttcgaaagt 1380
ggtgcaagta gtgccagtga gttggtaacg gaattgattc agttccagaa ttctaagaaa 1440
aatcgtttga gtcgtatgca agcaagtgtc ttgatggctg gtatgatgtt ggatactaaa 1500
aatttcacct cgcgagtaac tagtcggaca tttgatgttg ctagctatct cagaacgcgc 1560
ggaagtgata gtattgctat ccaggaaatc gctgcgacag attttgaaga atatcgtgag 1620
gtcaatgaac ttattttaca ggggcgtaaa ttaggttcag atgtactaat agcagaggct 1680
aaggacatga aatgctatga tacagtgtgt attagtaagg cagcagatgc catgttagcc 1740
atgtcaggta ttgaagcgag ttttgttctt gcgaagaata cacaaggatt tatctctatc 1800
tcagctcgaa gtcgtagtaa actgaatgta caacggatta tggaagagtt aggcgggtgga 1860
ggccacttta atttggcagc agctcaaatt aaagatgtaa ccttgtcaga agcaggtgaa 1920
aaactgacag aaattgtatt aaatgaaatg aaggaaaagg agaaagaaga atga 1974

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<210> 124

<211> 657

<212> PRT

<213> Streptococcus pneumoniae

<400> 124

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Met Lys Lys Phe Tyr Val Ser Pro Ile Phe Pro Ile Leu Val Gly Leu
 1             5             10             15

Ile Ala Phe Gly Val Leu Ser Thr Phe Ile Ile Phe Val Asn Asn Asn
      20             25             30

Leu Leu Thr Val Leu Ile Leu Phe Leu Phe Val Gly Gly Tyr Val Phe
      35             40             45

Leu Phe Lys Lys Leu Arg Val His Tyr Thr Arg Ser Asp Val Glu Gln
      50             55             60

Ile Gln Tyr Val Asn His Gln Ala Glu Glu Ser Leu Thr Ala Leu Leu
      65             70             75             80

Glu Gln Met Pro Val Gly Val Met Lys Leu Asn Leu Ser Ser Gly Glu
      85             90             95

Val Glu Trp Phe Asn Pro Tyr Ala Glu Leu Ile Leu Thr Lys Glu Asp
      100            105            110

Gly Asp Phe Asp Leu Glu Ala Val Gln Thr Ile Ile Lys Ala Ser Val
      115            120            125

Gly Asn Pro Ser Thr Tyr Ala Lys Leu Gly Glu Lys Arg Tyr Ala Val
      130            135            140

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| His | Met | Asp | Ala | Ser | Ser | Gly | Val | Leu | Tyr | Phe | Val | Asp | Val | Ser | Arg |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |
| Glu | Gln | Ala | Ile | Thr | Asp | Glu | Leu | Val | Thr | Ser | Arg | Pro | Val | Ile | Gly |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |
| Ile | Val | Ser | Val | Asp | Asn | Tyr | Asp | Asp | Leu | Glu | Asp | Glu | Thr | Ser | Glu |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |
| Ser | Asp | Ile | Ser | Gln | Ile | Asn | Ser | Phe | Val | Ala | Asn | Phe | Ile | Ser | Glu |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |
| Phe | Ser | Glu | Lys | His | Met | Met | Phe | Ser | Arg | Arg | Val | Ser | Met | Asp | Arg |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |
| Phe | Tyr | Leu | Phe | Thr | Asp | Tyr | Thr | Val | Leu | Glu | Gly | Leu | Met | Asn | Asp |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |
| Lys | Phe | Ser | Val | Ile | Asp | Ala | Phe | Arg | Glu | Glu | Ser | Lys | Gln | Arg | Gln |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |
| Leu | Pro | Leu | Thr | Leu | Ser | Met | Gly | Phe | Ser | Tyr | Gly | Asp | Gly | Asn | His |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |
| Asp | Glu | Ile | Gly | Lys | Val | Ala | Leu | Leu | Asn | Leu | Asn | Leu | Ala | Glu | Val |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |
| Arg | Gly | Gly | Asp | Gln | Val | Val | Val | Lys | Glu | Asn | Asp | Glu | Thr | Lys | Asn |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |
| Pro | Val | Tyr | Phe | Gly | Gly | Gly | Ser | Ala | Ala | Ser | Ile | Lys | Arg | Thr | Arg |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |
| Thr | Arg | Thr | Arg | Ala | Met | Met | Thr | Ala | Ile | Ser | Asp | Lys | Ile | Arg | Ser |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |  |
| Val | Asp | Gln | Val | Phe | Val | Val | Gly | His | Lys | Asn | Leu | Asp | Met | Asp | Ala |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |
| Leu | Gly | Ser | Ala | Val | Gly | Met | Gln | Leu | Phe | Ala | Ser | Asn | Val | Ile | Glu |  |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |  |
| Asn | Ser | Tyr | Ala | Leu | Tyr | Asp | Glu | Glu | Gln | Met | Ser | Pro | Asp | Ile | Glu |  |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |  |
| Arg | Ala | Val | Ser | Phe | Ile | Glu | Lys | Glu | Gly | Val | Thr | Lys | Leu | Leu | Ser |  |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |  |
| Val | Lys | Asp | Ala | Met | Gly | Met | Val | Thr | Asn | Arg | Ser | Leu | Leu | Ile | Leu |  |
|     |     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |  |
| Val | Asp | His | Ser | Lys | Thr | Ala | Leu | Thr | Leu | Ser | Lys | Glu | Phe | Tyr | Asp |  |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |     |  |
| Leu | Phe | Thr | Gln | Thr | Ile | Val | Ile | Asp | His | His | Arg | Arg | Asp | Gln | Asp |  |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |  |

Phe Pro Asp Asn Ala Val Ile Thr Tyr Ile Glu Ser Gly Ala Ser Ser  
 450 455 460  
 Ala Ser Glu Leu Val Thr Glu Leu Ile Gln Phe Gln Asn Ser Lys Lys  
 465 470 475 480  
 Asn Arg Leu Ser Arg Met Gln Ala Ser Val Leu Met Ala Gly Met Met  
 485 490 495  
 Leu Asp Thr Lys Asn Phe Thr Ser Arg Val Thr Ser Arg Thr Phe Asp  
 500 505 510  
 Val Ala Ser Tyr Leu Arg Thr Arg Gly Ser Asp Ser Ile Ala Ile Gln  
 515 520 525  
 Glu Ile Ala Ala Thr Asp Phe Glu Glu Tyr Arg Glu Val Asn Glu Leu  
 530 535 540  
 Ile Leu Gln Gly Arg Lys Leu Gly Ser Asp Val Leu Ile Ala Glu Ala  
 545 550 555 560  
 Lys Asp Met Lys Cys Tyr Asp Thr Val Val Ile Ser Lys Ala Ala Asp  
 565 570 575  
 Ala Met Leu Ala Met Ser Gly Ile Glu Ala Ser Phe Val Leu Ala Lys  
 580 585 590  
 Asn Thr Gln Gly Phe Ile Ser Ile Ser Ala Arg Ser Arg Ser Lys Leu  
 595 600 605  
 Asn Val Gln Arg Ile Met Glu Glu Leu Gly Gly Gly Gly His Phe Asn  
 610 615 620  
 Leu Ala Ala Ala Gln Ile Lys Asp Val Thr Leu Ser Glu Ala Gly Glu  
 625 630 635 640  
 Lys Leu Thr Glu Ile Val Leu Asn Glu Met Lys Glu Lys Glu Lys Glu  
 645 650 655  
 Glu

<210> 125

<211> 663

<212> DNA

<213> Streptococcus pneumoniae

<400> 125

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 cttctgagga atgatgactc ttgtctttgt tcagactgtg attctacttt tgaaagaatt 120  
 ggggaagaga actgtccaaa ttgtatgaaa acagagtgtg caacaaaagtg tcaagattgt 180  
 caactttggt gtaaagaggg agttgaagtc agtcatagag cgatttttac ttacaatcaa 240  
 gctatgaagg attttttcag tcggtataag tttgatggag acttcctggt aagaaaagtt 300  
 ttcgcttcat ttttaagtga ggagttgaaa aagtacaaaag agtatcaatt tgttgtaatt 360  
 cccctaagtc ctgatagata tgctaataga ggatttaatc aggttgaggg cttggtagag 420

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gcagcaggct ttgagtatct ggatttatta gagaaaagag aagagagagc cagttcttct 480
aaaaatcggt cagagcgctt ggggacagaa cttcctttct ttattaaaag tggagtcact 540
attcctaataaa aaatcctact tatagatgat atctatacta caggagcaac tataaatcgt 600
gttaagaaac tgttggaaga agctgggtgct aaggatgtaa aaacattttc ccttgtaaga 660
tga
663

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<210> 126

<211> 220

<212> PRT

<213> Streptococcus pneumoniae

<400> 126

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Met Lys Cys Leu Leu Cys Gly Gln Thr Met Lys Thr Val Leu Thr Phe
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Ser Ser Leu Leu Leu Leu Arg Asn Asp Asp Ser Cys Leu Cys Ser Asp
      20             25             30

Cys Asp Ser Thr Phe Glu Arg Ile Gly Glu Glu Asn Cys Pro Asn Cys
      35             40             45

Met Lys Thr Glu Leu Ser Thr Lys Cys Gln Asp Cys Gln Leu Trp Cys
      50             55             60

Lys Glu Gly Val Glu Val Ser His Arg Ala Ile Phe Thr Tyr Asn Gln
      65             70             75             80

Ala Met Lys Asp Phe Phe Ser Arg Tyr Lys Phe Asp Gly Asp Phe Leu
      85             90             95

Leu Arg Lys Val Phe Ala Ser Phe Leu Ser Glu Glu Leu Lys Lys Tyr
     100             105             110

Lys Glu Tyr Gln Phe Val Val Ile Pro Leu Ser Pro Asp Arg Tyr Ala
     115             120             125

Asn Arg Gly Phe Asn Gln Val Glu Gly Leu Val Glu Ala Ala Gly Phe
     130             135             140

Glu Tyr Leu Asp Leu Leu Glu Lys Arg Glu Glu Arg Ala Ser Ser Ser
     145             150             155             160

Lys Asn Arg Ser Glu Arg Leu Gly Thr Glu Leu Pro Phe Phe Ile Lys
     165             170             175

Ser Gly Val Thr Ile Pro Lys Lys Ile Leu Leu Ile Asp Asp Ile Tyr
     180             185             190

Thr Thr Gly Ala Thr Ile Asn Arg Val Lys Lys Leu Leu Glu Glu Ala
     195             200             205

Gly Ala Lys Asp Val Lys Thr Phe Ser Leu Val Arg
     210             215             220

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<210> 127  
 <211> 1299  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 127  
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 caacgctgta atagtactat tctagaagaa tgggtatttgc ccatcgggtgc ttactattgt 180  
 cgagagtgtc tgctgatgaa gcgagtcaga agtgatcaaa ctttatacta ttttccgcag 240  
 gaggattttc caaagcaaga tgttctcaaa tggcgcggcc aattaactcc ttttcaagag 300  
 aagggtgtcag agggattgtc tcaagtagta gacaagcaaa agccaacctt agttcatgcg 360  
 gtaacaggag ctggaaagac agaaatgatt tatcaagtag tggctaaagt gatcaatgcg 420  
 ggtggtgcag tgtgtttggc tagtcctcgc atagatgttt gtttggagct gtacaagcgc 480  
 ctgcaacagg atttttcttg cgggatagct ttgctacatg gagaatcgga accttatttt 540  
 cgaacaccac tagttgttgc aacaacccat cagttattga agttttatca agcttttgat 600  
 ttgctgatag tggatgaagt agatgctttt ccttatgttg ataatcccat gctttaccac 660  
 gctgtcaaga atagtgtaaa ggagaatgga ttgagaatct ttttaacagc gacttcgacc 720  
 aatgagttag ataaaaaggc ccgttttaga gaactaaaaa gactgaattt accgagacgg 780  
 tttcatggaa atcgtttgat tattccaaaa ccaatttggg tatcggattt taatcgctac 840  
 ttagacaaga atcgtttgtc accaaagtta aagtcctata ttgagaagca gagaaagaca 900  
 gcttatccgt tactcatttt tgcttcagaa attaagaaag gggagcagtt agcagaaatc 960  
 ttacaggagc aattttcaaa tgagaaaatt ggctttgtat cttctgtaac agaggatcga 1020  
 ttagagcaag tacaagcttt tcgagatgga gaactgacaa tacttatcag tacgacaatc 1080  
 ttggagcgcg gagttacctt cccttgtgtg gatgttttcg tagtagaggc caatcatcgt 1140  
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 ccgacaggag atttgctttt cttccatgat gggttaaatg cttcaatcaa gaaggcgatt 1260  
 aaggaaattc agatgatgaa taaggaggct ggtctatga 1299

<210> 128  
 <211> 432  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 128  
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 20 25 30  
 Lys Glu Lys Gly Lys Leu Phe Cys Gln Arg Cys Asn Ser Thr Ile Leu  
 35 40 45  
 Glu Glu Trp Tyr Leu Pro Ile Gly Ala Tyr Tyr Cys Arg Glu Cys Leu  
 50 55 60  
 Leu Met Lys Arg Val Arg Ser Asp Gln Thr Leu Tyr Tyr Phe Pro Gln  
 65 70 75 80  
 Glu Asp Phe Pro Lys Gln Asp Val Leu Lys Trp Arg Gly Gln Leu Thr  
 85 90 95  
 Pro Phe Gln Glu Lys Val Ser Glu Gly Leu Leu Gln Val Val Asp Lys  
 100 105 110

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
| Gln | Lys | Pro | Thr | Leu | Val | His | Ala | Val | Thr | Gly | Ala | Gly | Lys | Thr | Glu |  |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |  |
| Met | Ile | Tyr | Gln | Val | Val | Ala | Lys | Val | Ile | Asn | Ala | Gly | Gly | Ala | Val |  |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |  |
| Cys | Leu | Ala | Ser | Pro | Arg | Ile | Asp | Val | Cys | Leu | Glu | Leu | Tyr | Lys | Arg |  |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |  |
| Leu | Gln | Gln | Asp | Phe | Ser | Cys | Gly | Ile | Ala | Leu | Leu | His | Gly | Glu | Ser |  |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |  |
| Glu | Pro | Tyr | Phe | Arg | Thr | Pro | Leu | Val | Val | Ala | Thr | Thr | His | Gln | Leu |  |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |  |
| Leu | Lys | Phe | Tyr | Gln | Ala | Phe | Asp | Leu | Leu | Ile | Val | Asp | Glu | Val | Asp |  |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |  |
| Ala | Phe | Pro | Tyr | Val | Asp | Asn | Pro | Met | Leu | Tyr | His | Ala | Val | Lys | Asn |  |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |  |
| Ser | Val | Lys | Glu | Asn | Gly | Leu | Arg | Ile | Phe | Leu | Thr | Ala | Thr | Ser | Thr |  |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |  |
| Asn | Glu | Leu | Asp | Lys | Lys | Val | Arg | Leu | Gly | Glu | Leu | Lys | Arg | Leu | Asn |  |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |  |
| Leu | Pro | Arg | Arg | Phe | His | Gly | Asn | Pro | Leu | Ile | Ile | Pro | Lys | Pro | Ile |  |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |  |
| Trp | Leu | Ser | Asp | Phe | Asn | Arg | Tyr | Leu | Asp | Lys | Asn | Arg | Leu | Ser | Pro |  |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |  |
| Lys | Leu | Lys | Ser | Tyr | Ile | Glu | Lys | Gln | Arg | Lys | Thr | Ala | Tyr | Pro | Leu |  |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |  |
| Leu | Ile | Phe | Ala | Ser | Glu | Ile | Lys | Lys | Gly | Glu | Gln | Leu | Ala | Glu | Ile |  |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |  |
| Leu | Gln | Glu | Gln | Phe | Pro | Asn | Glu | Lys | Ile | Gly | Phe | Val | Ser | Ser | Val |  |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |  |  |
| Thr | Glu | Asp | Arg | Leu | Glu | Gln | Val | Gln | Ala | Phe | Arg | Asp | Gly | Glu | Leu |  |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |  |
| Thr | Ile | Leu | Ile | Ser | Thr | Thr | Ile | Leu | Glu | Arg | Gly | Val | Thr | Phe | Pro |  |  |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |  |  |
| Cys | Val | Asp | Val | Phe | Val | Val | Glu | Ala | Asn | His | Arg | Leu | Phe | Thr | Lys |  |  |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |  |  |
| Ser | Ser | Leu | Ile | Gln | Ile | Gly | Gly | Arg | Val | Gly | Arg | Ser | Met | Asp | Arg |  |  |
| 385 |     |     |     | 390 |     |     |     |     |     | 395 |     |     |     |     | 400 |  |  |
| Pro | Thr | Gly | Asp | Leu | Leu | Phe | Phe | His | Asp | Gly | Leu | Asn | Ala | Ser | Ile |  |  |
|     |     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |  |  |

Lys Lys Ala Ile Lys Glu Ile Gln Met Met Asn Lys Glu Ala Gly Leu  
420 425 430

<210> 129

<211> 870

<212> DNA

<213> Streptococcus pneumoniae

<400> 129

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atgcaaattc aaaaaagttt taaggggcag tctccctatg gcaagctgta tctagtggca 60
acgccgattg gcaatctaga tgatatgact ttctgtgcta tccagacctt gaaagaagtg 120
gactggattg ctgctgagga tacgcgcaat acagggcctt tgctcaagca ttttgacatt 180
tccaccaagc agatcagttt tcatgagcac aatgcccaagg aaaaaattcc tgatttgatt 240
ggtttcttga aagcagggca aagtattgct cagggtctctg atgccggttt gcctagcatt 300
tcagaccctg gtcattgatt agttaaggca gctattgagg aagaaattgc agttgtgaca 360
gttccaggtg cctctgcagg aatttctgcc ttgattgcca gtggtttagc gccacagcca 420
catatctttt acggtttttt accgagaaaa tcaggtcagc agaagcaatt ttttggcttg 480
aaaaaagatt atcctgaaac acagattttt tatgaatcac ctcacgtgt agcagacacg 540
ttggaaaata tgtagaagt ctacgggtgac cgctccgttg tcttggtcag ggaattgacc 600
aaaatctatg aagaatacca acgaggtact atctctgagt tattagaaag cattgctgaa 660
acgccactca agggcgaaat tcttctcatt gttgaggggt ccagtcaggg tgtggaggaa 720
aaggacgagg aagacttggt cgtagaaatt caaacccgca tccagcaagg tgtgaagaaa 780
aaccaagcta tcaaggaagt cgctaagatt taccagtgga ataaaagtca gctctacgct 840
gcctaccacg actggaaga aaaacaataa 870

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<210> 130

<211> 289

<212> PRT

<213> Streptococcus pneumoniae

<400> 130

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Met Gln Ile Gln Lys Ser Phe Lys Gly Gln Ser Pro Tyr Gly Lys Leu
  1             5             10             15

Tyr Leu Val Ala Thr Pro Ile Gly Asn Leu Asp Asp Met Thr Phe Arg
      20             25             30

Ala Ile Gln Thr Leu Lys Glu Val Asp Trp Ile Ala Ala Glu Asp Thr
      35             40             45

Arg Asn Thr Gly Leu Leu Leu Lys His Phe Asp Ile Ser Thr Lys Gln
      50             55             60

Ile Ser Phe His Glu His Asn Ala Lys Glu Lys Ile Pro Asp Leu Ile
      65             70             75             80

Gly Phe Leu Lys Ala Gly Gln Ser Ile Ala Gln Val Ser Asp Ala Gly
      85             90             95

Leu Pro Ser Ile Ser Asp Pro Gly His Asp Leu Val Lys Ala Ala Ile
      100            105            110

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Glu Glu Glu Ile Ala Val Val Thr Val Pro Gly Ala Ser Ala Gly Ile  
 115 120 125  
 Ser Ala Leu Ile Ala Ser Gly Leu Ala Pro Gln Pro His Ile Phe Tyr  
 130 135 140  
 Gly Phe Leu Pro Arg Lys Ser Gly Gln Gln Lys Gln Phe Phe Gly Leu  
 145 150 155 160  
 Lys Lys Asp Tyr Pro Glu Thr Gln Ile Phe Tyr Glu Ser Pro His Arg  
 165 170 175  
 Val Ala Asp Thr Leu Glu Asn Met Leu Glu Val Tyr Gly Asp Arg Ser  
 180 185 190  
 Val Val Leu Val Arg Glu Leu Thr Lys Ile Tyr Glu Glu Tyr Gln Arg  
 195 200 205  
 Gly Thr Ile Ser Glu Leu Leu Glu Ser Ile Ala Glu Thr Pro Leu Lys  
 210 215 220  
 Gly Glu Cys Leu Leu Ile Val Glu Gly Ala Ser Gln Gly Val Glu Glu  
 225 230 235 240  
 Lys Asp Glu Glu Asp Leu Phe Val Glu Ile Gln Thr Arg Ile Gln Gln  
 245 250 255  
 Gly Val Lys Lys Asn Gln Ala Ile Lys Glu Val Ala Lys Ile Tyr Gln  
 260 265 270  
 Trp Asn Lys Ser Gln Leu Tyr Ala Ala Tyr His Asp Trp Glu Glu Lys  
 275 280 285

Gln

<210> 131  
 <211> 345  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 131  
 atgataaaga aaggaaaggg ctgttttatg gacaaaaaag aattatttga cgcgctggat 60  
 gatttttccc aacaattatt ggtaacctta gccgatgtgg aagccatcaa gaaaaatctc 120  
 aagagcctgg tagaggaaaa tacagctctt cgcttggaat atagtaagtt gcgagaacgc 180  
 ttgggtgagg tggaagcaga tgctcctgtc aaggccaagc atgttcgcga aagtgtccgt 240  
 cgtatttacc gtgatggatt tcacgtatgt aatgattttt atggacaacg tcgagagcag 300  
 gacgaagaat gtatgttttg tgacgagttg ttatacaggg agtaa 345

<210> 132  
 <211> 114  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 132

Met Ile Lys Lys Gly Lys Gly Cys Phe Met Asp Lys Lys Glu Leu Phe  
1 5 10 15

Asp Ala Leu Asp Asp Phe Ser Gln Gln Leu Leu Val Thr Leu Ala Asp  
20 25 30

Val Glu Ala Ile Lys Lys Asn Leu Lys Ser Leu Val Glu Glu Asn Thr  
35 40 45

Ala Leu Arg Leu Glu Asn Ser Lys Leu Arg Glu Arg Leu Gly Glu Val  
50 55 60

Glu Ala Asp Ala Pro Val Lys Ala Lys His Val Arg Glu Ser Val Arg  
65 70 75 80

Arg Ile Tyr Arg Asp Gly Phe His Val Cys Asn Asp Phe Tyr Gly Gln  
85 90 95

Arg Arg Glu Gln Asp Glu Glu Cys Met Phe Cys Asp Glu Leu Leu Tyr  
100 105 110

Arg Glu

<210> 133

<211> 639

<212> DNA

<213> Streptococcus pneumoniae

<400> 133

atgtcaaaag gatttttagt ctctcttgag ggaccagagg gagcaggcaa gaccagtgtt 60  
ttagaggctc tgctaccaat ttagaggaa aaaggagtag aggtgttgac gaccctgaa 120  
cctggcggag tcttgattgg ggagaagatt cggaagtga ttttgatcc aagtcatact 180  
cagatggatg ctaaaacaga gctacttctc tatattgccg gtcgcagaca gcatttggtg 240  
gaaaaagtgc ttccagccct tgaagctggc aagttggtca tcatggatcg ttttatcgat 300  
agttctgttg cctatcaggg atttggtcgt ggcttagata ttgaagccat tgactggctc 360  
aatcagtttg cgacagatgg cctcaaaccg gatttgacac tctattttga catcgagggtg 420  
gaagaagggc tggctcgtat tgctgctaag agtgaccgag aggttaatcg tttggatttg 480  
gaagggttgg acttgcataa aaaagtctgt caaggctacc tttctcttct ggataaagag 540  
ggaaatcgca ttgtcaagat tgatgctagt ctccctttgg agcaagttgt ggaaactacc 600  
aaggctgtct tgtttgacgg aatgggcttg gccaaatga 639

<210> 134

<211> 212

<212> PRT

<213> Streptococcus pneumoniae

<400> 134

Met Ser Lys Gly Phe Leu Val Ser Leu Glu Gly Pro Glu Gly Ala Gly  
1 5 10 15

Lys Thr Ser Val Leu Glu Ala Leu Leu Pro Ile Leu Glu Glu Lys Gly



|   |     |     |
|---|-----|-----|
| 20  | 25  | 30  |
| Val Glu Val Leu Thr Thr Arg Glu Pro Gly Gly Val Leu Ile Gly Glu |     |     |
| 35  | 40  | 45  |
| Lys Ile Arg Glu Val Ile Leu Asp Pro Ser His Thr Gln Met Asp Ala |     |     |
| 50  | 55  | 60  |
| Lys Thr Glu Leu Leu Leu Tyr Ile Ala Ser Arg Arg Gln His Leu Val |     |     |
| 65  | 70  | 75  |
| Glu Lys Val Leu Pro Ala Leu Glu Ala Gly Lys Leu Val Ile Met Asp |     |     |
| 85  | 90  | 95  |
| Arg Phe Ile Asp Ser Ser Val Ala Tyr Gln Gly Phe Gly Arg Gly Leu |     |     |
| 100   | 105 | 110 |
| Asp Ile Glu Ala Ile Asp Trp Leu Asn Gln Phe Ala Thr Asp Gly Leu |     |     |
| 115   | 120 | 125 |
| Lys Pro Asp Leu Thr Leu Tyr Phe Asp Ile Glu Val Glu Glu Gly Leu |     |     |
| 130   | 135 | 140 |
| Ala Arg Ile Ala Ala Asn Ser Asp Arg Glu Val Asn Arg Leu Asp Leu |     |     |
| 145   | 150 | 155 |
| Glu Gly Leu Asp Leu His Lys Lys Val Arg Gln Gly Tyr Leu Ser Leu |     |     |
| 165   | 170 | 175 |
| Leu Asp Lys Glu Gly Asn Arg Ile Val Lys Ile Asp Ala Ser Leu Pro |     |     |
| 180   | 185 | 190 |
| Leu Glu Gln Val Val Glu Thr Thr Lys Ala Val Leu Phe Asp Gly Met |     |     |
| 195   | 200 | 205 |
| Gly Leu Ala Lys   |     |     |
| 210   |     |     |

<210> 135

<211> 474

<212> DNA

<213> Streptococcus pneumoniae

<400> 135

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atggtagaac aaagaaaatc aattaccatg aaagatgttg ctttagaagc aggagttagt 60
gttggaactg tttcacgtgt aattaataaa gaaaaaggca ttaaagaagt aactttgaaa 120
aaagtggaac aagcgattaa aactttgaat tacattccag attactacgc tagaggaatg 180
aaaaaaaaatc gaacagaaac gattgcaatc attgtaccaa gtatctggca tcccttcttt 240
tcagaatttg ctatgcatgt ggaaaatgaa gtctataaga gaaataacaa attactctta 300
tggtctatca atggtacaaa tagagagcaa gactatctgg agatgttgcg tcataataaa 360
gttgatggag tggttgccat tacctatagg ccaattgaac attacttgac gtcaggaatt 420
ccctttgtta gtattgaccg cacatactca gagattgcca ttccttgtgt ttca 474

```

<210> 136

<211> 158  
 <212> PRT  
 <213> Streptococcus pneumoniae  
  
 <400> 136  
 Met Val Glu Gln Arg Lys Ser Ile Thr Met Lys Asp Val Ala Leu Glu  
     1                    5                    10                    15  
 Ala Gly Val Ser Val Gly Thr Val Ser Arg Val Ile Asn Lys Glu Lys  
                     20                    25                    30  
 Gly Ile Lys Glu Val Thr Leu Lys Lys Val Glu Gln Ala Ile Lys Thr  
             35                    40                    45  
 Leu Asn Tyr Ile Pro Asp Tyr Tyr Ala Arg Gly Met Lys Lys Asn Arg  
     50                    55                    60  
 Thr Glu Thr Ile Ala Ile Ile Val Pro Ser Ile Trp His Pro Phe Phe  
     65                    70                    75                    80  
 Ser Glu Phe Ala Met His Val Glu Asn Glu Val Tyr Lys Arg Asn Asn  
                     85                    90                    95  
 Lys Leu Leu Leu Cys Ser Ile Asn Gly Thr Asn Arg Glu Gln Asp Tyr  
             100                    105                    110  
 Leu Glu Met Leu Arg His Asn Lys Val Asp Gly Val Val Ala Ile Thr  
             115                    120                    125  
 Tyr Arg Pro Ile Glu His Tyr Leu Thr Ser Gly Ile Pro Phe Val Ser  
     130                    135                    140  
 Ile Asp Arg Thr Tyr Ser Glu Ile Ala Ile Pro Cys Val Ser  
 145                    150                    155

<210> 137  
 <211> 374  
 <212> DNA  
 <213> Streptococcus pneumoniae  
  
 <400> 137  
 atgaatatat ttagaacaaa gaatgttagt ttagataaaa cagagatgca taggcatttg 60  
 aagttatggg atttgatttt gctgggtatc ggagccatgg tagggacagg cgtctttaca 120  
 atcacaggta ctgcagctgc aacacttgct ggcccagccc tagtgatttc aatcgttatt 180  
 tctgccttgt gtgtgggatt atcagccctc ttttttgcag aatttgcctc gcgagtaccc 240  
 gctacaggag gtgcctatag ttacctctat gctatccttag gagaattccc tgctgggttg 300  
 gctggttggt taaccatgat ggagttcatg acagccatat caggcgtagc ttcgggttgg 360  
 gcagcttatt ttaa 374

<210> 138  
 <211> 124  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 138

Met Asn Ile Phe Arg Thr Lys Asn Val Ser Leu Asp Lys Thr Glu Met  
1 5 10 15

His Arg His Leu Lys Leu Trp Asp Leu Ile Leu Leu Gly Ile Gly Ala  
20 25 30

Met Val Gly Thr Gly Val Phe Thr Ile Thr Gly Thr Ala Ala Ala Thr  
35 40 45

Leu Ala Gly Pro Ala Leu Val Ile Ser Ile Val Ile Ser Ala Leu Cys  
50 55 60

Val Gly Leu Ser Ala Leu Phe Phe Ala Glu Phe Ala Ser Arg Val Pro  
65 70 75 80

Ala Thr Gly Gly Ala Tyr Ser Tyr Leu Tyr Ala Ile Leu Gly Glu Phe  
85 90 95

Pro Ala Trp Leu Ala Gly Trp Leu Thr Met Met Glu Phe Met Thr Ala  
100 105 110

Ile Ser Gly Val Ala Ser Gly Trp Ala Ala Tyr Phe  
115 120

<210> 139

<211> 1311

<212> DNA

<213> Streptococcus pneumoniae

<400> 139

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cgtctggtag gaagcgtgac gatcgaggga gcaaaaaatg cagtcttacc cttgttggca 120
gcgactattc tagcaagtga aggaaagacc gtcttgcaga atgttccgat tttgtcggat 180
gtctttatta tgaatcaggt agttggtggt ttgaatgccca aggttgactt tgatgaggaa 240
gctcatcttg tcaaggtgga tgctactggc gacatcactg aggaagcccc ttacaagtat 300
gtcagcaaga tgcgcgcctc catcgttgta ttagggccaa tccttgcccc tgtgggtcat 360
gccaaggtat ccatgccagg tggttgtacg attggtagcc gtcctattga tcttcatttg 420
aaaggtctgg aagctatggg ggtaagatt agtcagacag ctggttacat cgaagccaag 480
gcagaacgct tgcattggtc tcatatctat atggactttc caagtgttgg tgcaacgcag 540
aacttgatga tggcagcgac tctggctgat ggggtgacag tgattgagaa tgctgcgcgt 600
gagcctgaga ttgttgactt agccattctc cttaatgaaa tgggagccaa ggtcaaaggt 660
gctggtacag agactataac cattactggt gttgagaaac ttcattggtac gactcacaat 720
gtagtccaag accgtatcga agcaggaacc ttatggttag ctgctgccat gactggtggt 780
gatgtcttga ttcgagacgc tgtctgggag cacaaccgtc ccttgattgc caagtactt 840
gaaatgggtg ttgaagtaat tgaagaagac gaaggaattc gtgttcgttc tcaactagaa 900
aatctaaaag ctgttcattg gaaaacctt cccacccag gatttccaac agatatgcag 960
gctcaattta cagccttgat gacagttgca aaaggcgaat caaccatggt ggagacagtt 1020
ttcgaaaatc gtttccaaca cctagaagag atgcgccgca tgggcttgca ttctgagatt 1080
atcctgata cagctcgat tgttggtgga cagcctttgc agggagcaga agttctttca 1140
actgaccttc gtgccagtgc ggccttgatt ttgacagggt tggtagcaca gggagaaact 1200
gtggtcggta aattggttca cttggataga ggttactacg gtttccatga gaagtggcg 1260
cagctagggt ctaagattca gcggattgag gcaagtgatg aagatgaata a 1311
```

<210> 140

<211> 436

<212> PRT

<213> Streptococcus pneumoniae

<400> 140

Met Lys Ser Arg Val Lys Glu Thr Ser Met Asp Lys Ile Val Val Gln  
1 5 10 15

Gly Gly Asp Asn Arg Leu Val Gly Ser Val Thr Ile Glu Gly Ala Lys  
20 25 30

Asn Ala Val Leu Pro Leu Leu Ala Ala Thr Ile Leu Ala Ser Glu Gly  
35 40 45

Lys Thr Val Leu Gln Asn Val Pro Ile Leu Ser Asp Val Phe Ile Met  
50 55 60

Asn Gln Val Val Gly Gly Leu Asn Ala Lys Val Asp Phe Asp Glu Glu  
65 70 75 80

Ala His Leu Val Lys Val Asp Ala Thr Gly Asp Ile Thr Glu Glu Ala  
85 90 95

Pro Tyr Lys Tyr Val Ser Lys Met Arg Ala Ser Ile Val Val Leu Gly  
100 105 110

Pro Ile Leu Ala Arg Val Gly His Ala Lys Val Ser Met Pro Gly Gly  
115 120 125

Cys Thr Ile Gly Ser Arg Pro Ile Asp Leu His Leu Lys Gly Leu Glu  
130 135 140

Ala Met Gly Val Lys Ile Ser Gln Thr Ala Gly Tyr Ile Glu Ala Lys  
145 150 155 160

Ala Glu Arg Leu His Gly Ala His Ile Tyr Met Asp Phe Pro Ser Val  
165 170 175

Gly Ala Thr Gln Asn Leu Met Met Ala Ala Thr Leu Ala Asp Gly Val  
180 185 190

Thr Val Ile Glu Asn Ala Ala Arg Glu Pro Glu Ile Val Asp Leu Ala  
195 200 205

Ile Leu Leu Asn Glu Met Gly Ala Lys Val Lys Gly Ala Gly Thr Glu  
210 215 220

Thr Ile Thr Ile Thr Gly Val Glu Lys Leu His Gly Thr Thr His Asn  
225 230 235 240

Val Val Gln Asp Arg Ile Glu Ala Gly Thr Phe Met Val Ala Ala Ala  
245 250 255

Met Thr Gly Gly Asp Val Leu Ile Arg Asp Ala Val Trp Glu His Asn  
260 265 270

Arg Pro Leu Ile Ala Lys Leu Leu Glu Met Gly Val Glu Val Ile Glu  
 275 280 285  
 Glu Asp Glu Gly Ile Arg Val Arg Ser Gln Leu Glu Asn Leu Lys Ala  
 290 295 300  
 Val His Val Lys Thr Leu Pro His Pro Gly Phe Pro Thr Asp Met Gln  
 305 310 315 320  
 Ala Gln Phe Thr Ala Leu Met Thr Val Ala Lys Gly Glu Ser Thr Met  
 325 330 335  
 Val Glu Thr Val Phe Glu Asn Arg Phe Gln His Leu Glu Glu Met Arg  
 340 345 350  
 Arg Met Gly Leu His Ser Glu Ile Ile Arg Asp Thr Ala Arg Ile Val  
 355 360 365  
 Gly Gly Gln Pro Leu Gln Gly Ala Glu Val Leu Ser Thr Asp Leu Arg  
 370 375 380  
 Ala Ser Ala Ala Leu Ile Leu Thr Gly Leu Val Ala Gln Gly Glu Thr  
 385 390 395 400  
 Val Val Gly Lys Leu Val His Leu Asp Arg Gly Tyr Tyr Gly Phe His  
 405 410 415  
 Glu Lys Leu Ala Gln Leu Gly Ala Lys Ile Gln Arg Ile Glu Ala Ser  
 420 425 430  
 Asp Glu Asp Glu  
 435

<210> 141

<211> 1101

<212> DNA

<213> Streptococcus pneumoniae

<400> 141

atgttattag cgtcaacagt agccttggtca tttgccccag tattggcaac tcaagcagaa 60  
 gaagttcttt ggactgcacg tagtggtgag caaatccaaa acgatttgac taaaacggac 120  
 aacaaaacaa gttataccgt acagtatggt gatactttga gcaccattgc agaagccttg 180  
 ggtgtagatg tcacagtgtc tgcgaatctg aacaaaatca ctaatatgga cttgattttc 240  
 ccagaaactg ttttgacaac gactgtcaat gaagcagaag aagtaacaga agttgaaatc 300  
 caaacacctc aagcagactc tagtgaagaa gtgacaactg cgacagcaga tttgaccact 360  
 aatcaagtga ccgttgatga tcaaactggt caggttgacg acctttctca accaattgca 420  
 gaagttacaa agacagtgat tgcttctgaa gaagtggcac catctacggg cacttctgtc 480  
 ccagaggagc aaacgaccga aacaactcgc ccagttgcag aagaagctcc tcaggaaacg 540  
 actccagctg agaagcagga aacacaaaca agccctcaag ctgcatcagc agtggaaagca 600  
 actacaacaa gttcagaagc aaaagaagta gcatcatcaa atggagctac agcagcagtt 660  
 tctacttatc aaccagaaga aacgaaagta atttcaacaa cttacgaggc tccagctgcy 720  
 cccgattatg ctggacttgc agtagcaaaa tctgaaaatg caggtcttca accacaaaca 780  
 gctgccttta agaagaaatt gctaacttgt ttggcattac atcctttagt ggttatcgtc 840  
 caggagacag tggagatcac ggaaaagggt tggctatcga ctttatggta ccagaacggt 900  
 cagaattagg ggataagatt gcggaatatg ctattcaaaa tatggccagc cgtggcatta 960

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gttacatcat ctggaaacaa cgtttctatg ctccattcga tagcaaatat gggccagcta 1020
acacttggaa cccaatgcca gaccgtggta gtgtgacaga aaatcactat gatcacgttc 1080
acgtttcaat gaatggataa                                     1100

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<210> 142
<211> 302
<212> PRT
<213> Streptococcus pneumoniae

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<400> 142
Met Leu Leu Ala Ser Thr Val Ala Leu Ser Phe Ala Pro Val Leu Ala
 1             5             10             15

Thr Gln Ala Glu Glu Val Leu Trp Thr Ala Arg Ser Val Glu Gln Ile
      20             25             30

Gln Asn Asp Leu Thr Lys Thr Asp Asn Lys Thr Ser Tyr Thr Val Gln
      35             40             45

Tyr Gly Asp Thr Leu Ser Thr Ile Ala Glu Ala Leu Gly Val Asp Val
      50             55             60

Thr Val Leu Ala Asn Leu Asn Lys Ile Thr Asn Met Asp Leu Ile Phe
      65             70             75             80

Pro Glu Thr Val Leu Thr Thr Thr Val Asn Glu Ala Glu Glu Val Thr
      85             90             95

Glu Val Glu Ile Gln Thr Pro Gln Ala Asp Ser Ser Glu Glu Val Thr
      100            105            110

Thr Ala Thr Ala Asp Leu Thr Thr Asn Gln Val Thr Val Asp Asp Gln
      115            120            125

Thr Val Gln Val Ala Asp Leu Ser Gln Pro Ile Ala Glu Val Thr Lys
      130            135            140

Thr Val Ile Ala Ser Glu Glu Val Ala Pro Ser Thr Gly Thr Ser Val
      145            150            155            160

Pro Glu Glu Gln Thr Thr Glu Thr Thr Arg Pro Val Ala Glu Glu Ala
      165            170            175

Pro Gln Glu Thr Thr Pro Ala Glu Lys Gln Glu Thr Gln Thr Ser Pro
      180            185            190

Gln Ala Ala Ser Ala Val Glu Ala Thr Thr Thr Ser Ser Glu Ala Lys
      195            200            205

Glu Val Ala Ser Ser Asn Gly Ala Thr Ala Ala Val Ser Thr Tyr Gln
      210            215            220

Pro Glu Glu Thr Lys Val Ile Ser Thr Thr Tyr Glu Ala Pro Ala Ala

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|   |     |     |  |     |  |     |
|---|-----|-----|--|-----|--|-----|
| 225   |     | 230 |  | 235 |  | 240 |
| Pro Asp Tyr Ala Gly Leu Ala Val Ala Lys Ser Glu Asn Ala Gly Leu |     |     |  |     |  |     |
|   | 245 |     |  | 250 |  | 255 |
| Gln Pro Gln Thr Ala Ala Phe Lys Lys Lys Leu Leu Thr Cys Leu Ala |     |     |  |     |  |     |
|   | 260 |     |  | 265 |  | 270 |
| Leu His Pro Leu Val Val Ile Val Gln Glu Thr Val Glu Ile Thr Glu |     |     |  |     |  |     |
|   | 275 |     |  | 280 |  | 285 |
| Lys Val Trp Leu Ser Thr Leu Trp Tyr Gln Asn Val Gln Asn         |     |     |  |     |  |     |
|   | 290 |     |  | 295 |  | 300 |

<210> 143  
 <211> 1281  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 143

|             |            |             |            |             |            |      |
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| ttgtttaaga  | aaaataaaga | cattcttaat  | attgcattgc | cagctatggg  | tgaaaacttt | 60   |
| ttgcagatgc  | taatgggaat | gggtggacagt | tatttggttg | ctcatttagg  | attgatagct | 120  |
| atttcagggg  | tttcagtagc | tggtaatatt  | atcaccattt | atcaggcgat  | tttcatcgct | 180  |
| ctgggagctg  | ctatttccag | tgttatttca  | aaaagcatag | ggcagaaaaga | ccagtcgaag | 240  |
| ttggcctatc  | atgtgactga | ggcgttgaag  | attaccttac | tattaagttt  | ccttttagga | 300  |
| tttttgtcca  | tcttcgctgg | gaaagagatg  | ataggacttt | tggggacgga  | gagggatgta | 360  |
| gctgagagtg  | gtggactgta | tctatctttg  | gtaggcggat | cgattgttct  | cttaggttta | 420  |
| atgactagtc  | taggagcctt | gattcgtgca  | acgcataatc | cacgtctgcc  | tctctatgtt | 480  |
| agttttttat  | ccaatgcctt | gaatattctt  | ttttcaagtc | tagctatttt  | tggtctggat | 540  |
| atggggatag  | ctggtgttgc | ttgggggaca  | attgtgtctc | gtttggttgg  | tcttgtgatt | 600  |
| ttgtgggtcac | aattaaaact | gccttatggg  | aagccaactt | ttggtttaga  | taaggaactg | 660  |
| ttgaccttgg  | ctttaccagc | agctggagag  | cgacttatga | tgagggctgg  | agatgtagtg | 720  |
| atcattgcct  | tggtcgtttc | ttttgggacg  | gaggcagttg | ctgggaatgc  | aatcggagaa | 780  |
| gtcttgaccc  | agtttaacta | tatgcctgcc  | tttggcgctg | ctacggcaac  | ggtcagtctg | 840  |
| ttggcccagag | cagttggaga | ggatgattgg  | aaaagagttg | ctagtttgag  | taaacaaacc | 900  |
| ttttggcttt  | ctctgttctt | catgttgccc  | ctgtccttta | gtatatatgt  | cttgggtgta | 960  |
| ccattaactc  | atctctatac | gactgattct  | ctagcgggtg | aggctagtgt  | tctagtgaca | 1020 |
| ctgttttcac  | tacttgggac | ccctatgacg  | acaggaacag | tcatctatac  | ggcagtcctg | 1080 |
| cagggattag  | gaaatgcacg | cctccctttt  | tatgcgacaa | gtataggaat  | gtggtgtatc | 1140 |
| cgcattggga  | caggatatct | gatggggatt  | gtgcttggtt | ggggcttgcc  | tggtatttgg | 1200 |
| gcagggtctc  | tcttggataa | tggttttcgc  | tggttatttc | tacgctatcg  | ttaccagcgc | 1260 |
| tatatgagct  | tgaaaggata | g           |            |             |            | 1281 |

<210> 144  
 <211> 426  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 144

|   |
|---|
| Leu Phe Lys Lys Asn Lys Asp Ile Leu Asn Ile Ala Leu Pro Ala Met |
| 1 5 10 15   |
| Gly Glu Asn Phe Leu Gln Met Leu Met Gly Met Val Asp Ser Tyr Leu |
| 20 25 30  |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Val | Ala | His | Leu | Gly | Leu | Ile | Ala | Ile | Ser | Gly | Val | Ser | Val | Ala | Gly |  |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |  |
| Asn | Ile | Ile | Thr | Ile | Tyr | Gln | Ala | Ile | Phe | Ile | Ala | Leu | Gly | Ala | Ala |  |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |  |
| Ile | Ser | Ser | Val | Ile | Ser | Lys | Ser | Ile | Gly | Gln | Lys | Asp | Gln | Ser | Lys |  |
|     | 65  |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |
| Leu | Ala | Tyr | His | Val | Thr | Glu | Ala | Leu | Lys | Ile | Thr | Leu | Leu | Leu | Ser |  |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |  |
| Phe | Leu | Leu | Gly | Phe | Leu | Ser | Ile | Phe | Ala | Gly | Lys | Glu | Met | Ile | Gly |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |
| Leu | Leu | Gly | Thr | Glu | Arg | Asp | Val | Ala | Glu | Ser | Gly | Gly | Leu | Tyr | Leu |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |
| Ser | Leu | Val | Gly | Gly | Ser | Ile | Val | Leu | Leu | Gly | Leu | Met | Thr | Ser | Leu |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |
| Gly | Ala | Leu | Ile | Arg | Ala | Thr | His | Asn | Pro | Arg | Leu | Pro | Leu | Tyr | Val |  |
|     | 145 |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |
| Ser | Phe | Leu | Ser | Asn | Ala | Leu | Asn | Ile | Leu | Phe | Ser | Ser | Leu | Ala | Ile |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |
| Phe | Val | Leu | Asp | Met | Gly | Ile | Ala | Gly | Val | Ala | Trp | Gly | Thr | Ile | Val |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |
| Ser | Arg | Leu | Val | Gly | Leu | Val | Ile | Leu | Trp | Ser | Gln | Leu | Lys | Leu | Pro |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |
| Tyr | Gly | Lys | Pro | Thr | Phe | Gly | Leu | Asp | Lys | Glu | Leu | Leu | Thr | Leu | Ala |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |
| Leu | Pro | Ala | Ala | Gly | Glu | Arg | Leu | Met | Met | Arg | Ala | Gly | Asp | Val | Val |  |
|     | 225 |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |
| Ile | Ile | Ala | Leu | Val | Val | Ser | Phe | Gly | Thr | Glu | Ala | Val | Ala | Gly | Asn |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |
| Ala | Ile | Gly | Glu | Val | Leu | Thr | Gln | Phe | Asn | Tyr | Met | Pro | Ala | Phe | Gly |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |
| Val | Ala | Thr | Ala | Thr | Val | Met | Leu | Leu | Ala | Arg | Ala | Val | Gly | Glu | Asp |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |
| Asp | Trp | Lys | Arg | Val | Ala | Ser | Leu | Ser | Lys | Gln | Thr | Phe | Trp | Leu | Ser |  |
|     |     | 290 |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |
| Leu | Phe | Leu | Met | Leu | Pro | Leu | Ser | Phe | Ser | Ile | Tyr | Val | Leu | Gly | Val |  |
|     | 305 |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |
| Pro | Leu | Thr | His | Leu | Tyr | Thr | Thr | Asp | Ser | Leu | Ala | Val | Glu | Ala | Ser |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |  |



Val Leu Val Thr Leu Phe Ser Leu Leu Gly Thr Pro Met Thr Thr Gly  
340 345 350

Thr Val Ile Tyr Thr Ala Val Trp Gln Gly Leu Gly Asn Ala Arg Leu  
355 360 365

Pro Phe Tyr Ala Thr Ser Ile Gly Met Trp Cys Ile Arg Ile Gly Thr  
370 375 380

Gly Tyr Leu Met Gly Ile Val Leu Gly Trp Gly Leu Pro Gly Ile Trp  
385 390 395 400

Ala Gly Ser Leu Leu Asp Asn Gly Phe Arg Trp Leu Phe Leu Arg Tyr  
405 410 415

Arg Tyr Gln Arg Tyr Met Ser Leu Lys Gly  
420 425

<210> 145  
<211> 894  
<212> DNA  
<213> Streptococcus pneumoniae

<400> 145  
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cagttatctc gctttgagct tggggagctc gacctggcag tctcccgttt ctttgagatt 180  
ttggataaca ttcatgtaac aatcgaaaat ttcatggata aggcaaggaa ttttcataat 240  
catgaacatg tgtctatgat ggcacagatt atcccacttt actattcaaa cgatattgca 300  
ggttttcaaa agcttcaaag agaacaactt gaaaagtcta agagttcgac gactcccctt 360  
tattttgagc tgaactggat tttgctacaa ggtctgattt gtcaaagaga tgcgagttat 420  
gatatgaagc aggatgattt gggtaaggta gcagattatc tcttcaaaac agaagaatgg 480  
accatgtatg agttgattct ttctcgtaac ctctatagtt tctacgatgt agactatgtc 540  
actcggattg gtagagaagt tatggagagg gaggaatttt accaagagat tagtcgccat 600  
aagagattag tgttgatttt ggccctcaat tgttaccagc attgttttaga gcattcttct 660  
ttttataatg ccaactatth tgaggcttat acagagaaga ttattgacaa aggtattaag 720  
ctttatgagc gtaatgtttt ccattattta aaaggttttg ccttatatca aaaaggacag 780  
tgtaaagaag gctgtaagca gatgcaagag gccatgcata tttttgatgt gttaggtctt 840  
ccagagcaag tagcctatta tcaggaacac tacgaaaaat ttgtcaaaag ttaa 894

<210> 146  
<211> 297  
<212> PRT  
<213> Streptococcus pneumoniae

<400> 146  
Val Gly Arg Ile Ile Arg Ala Gly Val Lys Met Glu His Leu Gly Lys  
1 5 10 15

Val Phe Arg Glu Phe Arg Thr Ser Gly Asn Tyr Ser Leu Lys Glu Ala  
20 25 30

Ala Gly Glu Ser Cys Ser Thr Ser Gln Leu Ser Arg Phe Glu Leu Gly

| 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Glu | Ser | Asp | Leu | Ala | Val | Ser | Arg | Phe | Phe | Glu | Ile | Leu | Asp | Asn | Ile |  |
| 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |     |  |
| His | Val | Thr | Ile | Glu | Asn | Phe | Met | Asp | Lys | Ala | Arg | Asn | Phe | His | Asn |  |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |
| His | Glu | His | Val | Ser | Met | Met | Ala | Gln | Ile | Ile | Pro | Leu | Tyr | Tyr | Ser |  |
| 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |     |     |     |     |  |
| Asn | Asp | Ile | Ala | Gly | Phe | Gln | Lys | Leu | Gln | Arg | Glu | Gln | Leu | Glu | Lys |  |
| 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |     |     |     |  |
| Ser | Lys | Ser | Ser | Thr | Thr | Pro | Leu | Tyr | Phe | Glu | Leu | Asn | Trp | Ile | Leu |  |
| 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |     |     |  |
| Leu | Gln | Gly | Leu | Ile | Cys | Gln | Arg | Asp | Ala | Ser | Tyr | Asp | Met | Lys | Gln |  |
| 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |     |  |
| Asp | Asp | Leu | Gly | Lys | Val | Ala | Asp | Tyr | Leu | Phe | Lys | Thr | Glu | Glu | Trp |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |
| Thr | Met | Tyr | Glu | Leu | Ile | Leu | Phe | Gly | Asn | Leu | Tyr | Ser | Phe | Tyr | Asp |  |
| 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |     |     |     |     |  |
| Val | Asp | Tyr | Val | Thr | Arg | Ile | Gly | Arg | Glu | Val | Met | Glu | Arg | Glu | Glu |  |
| 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |     |     |     |  |
| Phe | Tyr | Gln | Glu | Ile | Ser | Arg | His | Lys | Arg | Leu | Val | Leu | Ile | Leu | Ala |  |
| 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |     |     |  |
| Leu | Asn | Cys | Tyr | Gln | His | Cys | Leu | Glu | His | Ser | Ser | Phe | Tyr | Asn | Ala |  |
| 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |     |  |
| Asn | Tyr | Phe | Glu | Ala | Tyr | Thr | Glu | Lys | Ile | Ile | Asp | Lys | Gly | Ile | Lys |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |
| Leu | Tyr | Glu | Arg | Asn | Val | Phe | His | Tyr | Leu | Lys | Gly | Phe | Ala | Leu | Tyr |  |
| 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |     |     |     |     |  |
| Gln | Lys | Gly | Gln | Cys | Lys | Glu | Gly | Cys | Lys | Gln | Met | Gln | Glu | Ala | Met |  |
| 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |     |     |     |  |
| His | Ile | Phe | Asp | Val | Leu | Gly | Leu | Pro | Glu | Gln | Val | Ala | Tyr | Tyr | Gln |  |
| 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |     |     |  |
| Glu | His | Tyr | Glu | Lys | Phe | Val | Lys | Ser |     |     |     |     |     |     |     |  |
| 290 |     |     |     |     | 295 |     |     |     |     |     |     |     |     |     |     |  |

<210> 147

<211> 1068

<212> DNA

<213> Streptococcus pneumoniae

<400> 147

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cagcgccgta ttctttattc tatgaataag gatagcaata cttttgacaa gagctaccgt 180
aagtcggcca agtcagtcgg gaacatcatg ggggaatttcc acccacacgg ggattcttct 240
atctatgatg ccatgggttcg tatgtcacag aactggaaaa atcgtgagat tctagttgaa 300
atgcacggta ataacggttc tatggacgga gatcctcctg cggctatgcg ttatactgag 360
gcacgtttgt ctgaaattgc aggctacctt cttcaggata tcgagaaaaa gacagttcct 420
tttgcatgga actttgacga tacggagaaa gaaccaacgg tcttgccagc agcctttcca 480
aacctcttgg tcaatggttc gactgggatt tcggctggtt atgccacaga cattcctccc 540
cataatthag ctgaggtcat agatgctgca gtttacatga ttgaccaccc aactgcaaag 600
attgataaac tcatggaatt cttgcctgga ccagacttcc ctacaggggc tattattcag 660
ggtcgtgatg aaatcaagaa agcttatgag actgggaaaag ggcgcgtggt tgttcgttcc 720
aagactgaaa ttgaaaagct aaaaggtggt aaggaacaaa tcgttattat tgagattcct 780
tatgaaatca ataaggccaa tctagtcaag aaaatcgtg atgttcgtgt taataacaag 840
gtagctggga ttgctgaggt tcgtgatgag tctgaccgtg atggtcttcg tatcgctatc 900
gaacttaaga aagacgctaa tactgagctt gttctcaact acttatttaa gtacaccgac 960
ctacaaatca actacaactt taatatggtg gcgattgaca atttcacacc tcgtcaggtt 1020
ggattgttcc aatcctgtct agctatatcg ctcaccgtcg agaagtga 1068
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<210> 148

<211> 355

<212> PRT

<213> Streptococcus pneumoniae

<400> 148

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Phe Gly Arg Tyr Ser Lys Tyr Ile Ile Gln Asp Arg Ala Leu Pro Asp
      20             25             30

Ile Arg Asp Gly Leu Lys Pro Val Gln Arg Arg Ile Leu Tyr Ser Met
      35             40             45

Asn Lys Asp Ser Asn Thr Phe Asp Lys Ser Tyr Arg Lys Ser Ala Lys
      50             55             60

Ser Val Gly Asn Ile Met Gly Asn Phe His Pro His Gly Asp Ser Ser
      65             70             75             80

Ile Tyr Asp Ala Met Val Arg Met Ser Gln Asn Trp Lys Asn Arg Glu
      85             90             95

Ile Leu Val Glu Met His Gly Asn Asn Gly Ser Met Asp Gly Asp Pro
      100            105            110

Pro Ala Ala Met Arg Tyr Thr Glu Ala Arg Leu Ser Glu Ile Ala Gly
      115            120            125

Tyr Leu Leu Gln Asp Ile Glu Lys Lys Thr Val Pro Phe Ala Trp Asn
      130            135            140

Phe Asp Asp Thr Glu Lys Glu Pro Thr Val Leu Pro Ala Ala Phe Pro
      145            150            155            160
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Asn Leu Leu Val Asn Gly Ser Thr Gly Ile Ser Ala Gly Tyr Ala Thr  
 165 170 175  
 Asp Ile Pro Pro His Asn Leu Ala Glu Val Ile Asp Ala Ala Val Tyr  
 180 185 190  
 Met Ile Asp His Pro Thr Ala Lys Ile Asp Lys Leu Met Glu Phe Leu  
 195 200 205  
 Pro Gly Pro Asp Phe Pro Thr Gly Ala Ile Ile Gln Gly Arg Asp Glu  
 210 215 220  
 Ile Lys Lys Ala Tyr Glu Thr Gly Lys Gly Arg Val Val Val Arg Ser  
 225 230 235 240  
 Lys Thr Glu Ile Glu Lys Leu Lys Gly Gly Lys Glu Gln Ile Val Ile  
 245 250 255  
 Ile Glu Ile Pro Tyr Glu Ile Asn Lys Ala Asn Leu Val Lys Lys Ile  
 260 265 270  
 Asp Asp Val Arg Val Asn Asn Lys Val Ala Gly Ile Ala Glu Val Arg  
 275 280 285  
 Asp Glu Ser Asp Arg Asp Gly Leu Arg Ile Ala Ile Glu Leu Lys Lys  
 290 295 300  
 Asp Ala Asn Thr Glu Leu Val Leu Asn Tyr Leu Phe Lys Tyr Thr Asp  
 305 310 315 320  
 Leu Gln Ile Asn Tyr Asn Phe Asn Met Val Ala Ile Asp Asn Phe Thr  
 325 330 335  
 Pro Arg Gln Val Gly Leu Phe Gln Ser Cys Leu Ala Ile Ser Leu Thr  
 340 345 350  
 Val Glu Lys  
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<210> 149

<211> 684

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 149

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acttctgtta accctgggga aggaaaaaca actacttcca taaatatagc atggtcggtt 180
gcgcgtgcag gctataaaac tcttttgatc gatggcgata ctcgaaattc agttatgtta 240
ggagttttta aatctcgtga aaaaattaca gggctaacag aatttttatc tgggacagct 300
gatttatctc acggtttatg tgatacaaat attgaaaatt tatttgtagt tcaatcggga 360
tctgtatcac caaacctac agccttggtta caaagtaaaa attttaatga tatgattgaa 420
acattgcgta aatatatttga ttatatcatt attgatacac cgcctattgg aattgttatt 480
gatgcggcaa ttatcactca aaagtgtgat gcgtccatct tggtaacagc aacagggtgag 540
gcgaataaac gtgatatcca aaaagcgaaa caacaattaa aacaaacagg gaaactgttc 600

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ctaggagttg ttttaaataa attggatatc tcggttaata agtatggagt ttacggttcc 660  
tatggaaatt atggtaaaaa ataa 684

<210> 150

<211> 227

<212> PRT

<213> Streptococcus pneumoniae

<400> 150

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1 5 10 15

Ala Glu Glu Tyr Tyr Asn Ala Leu Cys Thr Asn Ile Gln Leu Ser Gly  
20 25 30

Asp Lys Leu Lys Val Ile Ser Val Thr Ser Val Asn Pro Gly Glu Gly  
35 40 45

Lys Thr Thr Thr Ser Ile Asn Ile Ala Trp Ser Phe Ala Arg Ala Gly  
50 55 60

Tyr Lys Thr Leu Leu Ile Asp Gly Asp Thr Arg Asn Ser Val Met Leu  
65 70 75 80

Gly Val Phe Lys Ser Arg Glu Lys Ile Thr Gly Leu Thr Glu Phe Leu  
85 90 95

Ser Gly Thr Ala Asp Leu Ser His Gly Leu Cys Asp Thr Asn Ile Glu  
100 105 110

Asn Leu Phe Val Val Gln Ser Gly Ser Val Ser Pro Asn Pro Thr Ala  
115 120 125

Leu Leu Gln Ser Lys Asn Phe Asn Asp Met Ile Glu Thr Leu Arg Lys  
130 135 140

Tyr Phe Asp Tyr Ile Ile Ile Asp Thr Pro Pro Ile Gly Ile Val Ile  
145 150 155 160

Asp Ala Ala Ile Ile Thr Gln Lys Cys Asp Ala Ser Ile Leu Val Thr  
165 170 175

Ala Thr Gly Glu Ala Asn Lys Arg Asp Ile Gln Lys Ala Lys Gln Gln  
180 185 190

Leu Lys Gln Thr Gly Lys Leu Phe Leu Gly Val Val Leu Asn Lys Leu  
195 200 205

Asp Ile Ser Val Asn Lys Tyr Gly Val Tyr Gly Ser Tyr Gly Asn Tyr  
210 215 220

Gly Lys Lys  
225

<210> 151  
 <211> 1194  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 151  
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 caaaaaagta gtgtaaaca ctctaacaac aatagtacta ttacacaaac tgcctataag 180  
 aacgaaaatt caacaacaca ggctgttaac aaagtaaaag atgctgttgt ttctgttatt 240  
 acttattcgg caaacagaca aaatagcgta tttggcaatg atgatactga cacagattct 300  
 cagcgaatct ctagtgaagg atctggagtt atttataaaa agaataataa agaagcttac 360  
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 gggactaaag tacctggaga aattgtcgga gctgacactt tctctgatat tgctgtcgtc 480  
 aaaatctctt cagaaaaagt gacaacagta gctgagtttg gtgattctag taagttaact 540  
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 gctattttcta caaaagccat ccaaactgat actgctatta acccaggtaa ctctggcggc 720  
 ccactgatca atattcaagg gcagggtatc ggaattacct caagtaaaat tgctacaaat 780  
 ggaggaacat ctgtagaagg tcttggtttc gcaattcctg caaatgatgc tatcaatatt 840  
 attgaacagt tagaaaaaaa cggaaaagt acgcgtccag ctttgggaat ccagatggtt 900  
 aatttatcta atgtgagtac aagcgacatc agaagactca atattccaag taatgttaca 960  
 tctggtgtaa ttgttcgttc ggtacaaaagt aatatgcctg ccaatggtca ccttgaaaaa 1020  
 tacgatgtaa ttacaaaagt agatgacaaa gagattgctt catcaacaga cttacaaagt 1080  
 gctctttaca accattctat cggagacacc attaagataa cctactatcg taacgggaaa 1140  
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<210> 152  
 <211> 397  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 152  
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 1 5 10 15  
 Gln Leu Leu Val Val Ile Val Ile Ser Phe Phe Ser Gly Ala Leu Gly  
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 Ser Phe Ser Ile Thr Gln Leu Thr Gln Lys Ser Ser Val Asn Asn Ser  
 35 40 45  
 Asn Asn Asn Ser Thr Ile Thr Gln Thr Ala Tyr Lys Asn Glu Asn Ser  
 50 55 60  
 Thr Thr Gln Ala Val Asn Lys Val Lys Asp Ala Val Val Ser Val Ile  
 65 70 75 80  
 Thr Tyr Ser Ala Asn Arg Gln Asn Ser Val Phe Gly Asn Asp Asp Thr  
 85 90 95  
 Asp Thr Asp Ser Gln Arg Ile Ser Ser Glu Gly Ser Gly Val Ile Tyr  
 100 105 110  
 Lys Lys Asn Asp Lys Glu Ala Tyr Ile Val Thr Asn Asn His Val Ile  
 115 120 125

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Asn | Gly | Ala | Ser | Lys | Val | Asp | Ile | Arg | Leu | Ser | Asp | Gly | Thr | Lys | Val | 130 | 135 | 140 |
| Pro | Gly | Glu | Ile | Val | Gly | Ala | Asp | Thr | Phe | Ser | Asp | Ile | Ala | Val | Val | 145 | 150 | 155 |
| Lys | Ile | Ser | Ser | Glu | Lys | Val | Thr | Thr | Val | Ala | Glu | Phe | Gly | Asp | Ser | 165 | 170 | 175 |
| Ser | Lys | Leu | Thr | Val | Gly | Glu | Thr | Ala | Ile | Ala | Ile | Gly | Ser | Pro | Leu | 180 | 185 | 190 |
| Gly | Ser | Glu | Tyr | Ala | Asn | Thr | Val | Thr | Gln | Gly | Ile | Val | Ser | Ser | Leu | 195 | 200 | 205 |
| Asn | Arg | Asn | Val | Ser | Leu | Lys | Ser | Glu | Asp | Gly | Gln | Ala | Ile | Ser | Thr | 210 | 215 | 220 |
| Lys | Ala | Ile | Gln | Thr | Asp | Thr | Ala | Ile | Asn | Pro | Gly | Asn | Ser | Gly | Gly | 225 | 230 | 235 |
| Pro | Leu | Ile | Asn | Ile | Gln | Gly | Gln | Val | Ile | Gly | Ile | Thr | Ser | Ser | Lys | 245 | 250 | 255 |
| Ile | Ala | Thr | Asn | Gly | Gly | Thr | Ser | Val | Glu | Gly | Leu | Gly | Phe | Ala | Ile | 260 | 265 | 270 |
| Pro | Ala | Asn | Asp | Ala | Ile | Asn | Ile | Ile | Glu | Gln | Leu | Glu | Lys | Asn | Gly | 275 | 280 | 285 |
| Lys | Val | Thr | Arg | Pro | Ala | Leu | Gly | Ile | Gln | Met | Val | Asn | Leu | Ser | Asn | 290 | 295 | 300 |
| Val | Ser | Thr | Ser | Asp | Ile | Arg | Arg | Leu | Asn | Ile | Pro | Ser | Asn | Val | Thr | 305 | 310 | 315 |
| Ser | Gly | Val | Ile | Val | Arg | Ser | Val | Gln | Ser | Asn | Met | Pro | Ala | Asn | Gly | 325 | 330 | 335 |
| His | Leu | Glu | Lys | Tyr | Asp | Val | Ile | Thr | Lys | Val | Asp | Asp | Lys | Glu | Ile | 340 | 345 | 350 |
| Ala | Ser | Ser | Thr | Asp | Leu | Gln | Ser | Ala | Leu | Tyr | Asn | His | Ser | Ile | Gly | 355 | 360 | 365 |
| Asp | Thr | Ile | Lys | Ile | Thr | Tyr | Tyr | Arg | Asn | Gly | Lys | Glu | Glu | Thr | Thr | 370 | 375 | 380 |
| Ser | Ile | Lys | Leu | Asn | Lys | Ser | Ser | Gly | Asp | Leu | Glu | Ser |     |     |     | 385 | 390 | 395 |

<210> 153

<211> 939

<212> DNA

<213> Streptococcus pneumoniae

<400> 153

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taccagtgtg tcaaggaaac agaccatgca gaaacgggtc aagtgattta cgatgagaag 180
gaagtgtcac tcagagagat tttactttat tatttccgag ttatcgatcc tctatctatc 240
aatcaacaag ggaatgaccg tggtcgccaa tatcgaactg ggatttatta tcaggatgaa 300
gcagatttgc cagctatcta cacagtgggt caggagcagg aacgcatgct gggtcgaaa 360
attgcagtag aagtggagca attacgccac tacattctgg ctgaagacta ccaccaagac 420
tatctcagga agaatccttc aggttactgt catatcgatg tgaccgatgc tgataagcca 480
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gaagagtctt atcgtgtcac acaagaagct gctacagagg ctccatttac caatgcctat 600
gaccaaacct ttgaagaggg gatttatgta gatattacga caggtgagcc actctttttt 660
gccaaaggata agtttgcttc aggttgtggt tggccaagtt ttagccgtcc gatttccaaa 720
gagttgattc attattacaa ggatctgagc catggaatgg agcgaattga agttcgttct 780
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<210> 154

<211> 312

<212> PRT

<213> Streptococcus pneumoniae

<400> 154

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Tyr Phe Ser Arg Ile Ser Gly Val Leu Glu Thr Ser Val Gly Tyr Ala
      20             25             30

Asn Gly Gln Val Glu Thr Thr Asn Tyr Gln Leu Leu Lys Glu Thr Asp
    35             40             45

His Ala Glu Thr Val Gln Val Ile Tyr Asp Glu Lys Glu Val Ser Leu
    50             55             60

Arg Glu Ile Leu Leu Tyr Tyr Phe Arg Val Ile Asp Pro Leu Ser Ile
    65             70             75             80

Asn Gln Gln Gly Asn Asp Arg Gly Arg Gln Tyr Arg Thr Gly Ile Tyr
    85             90             95

Tyr Gln Asp Glu Ala Asp Leu Pro Ala Ile Tyr Thr Val Val Gln Glu
   100             105             110

Gln Glu Arg Met Leu Gly Arg Lys Ile Ala Val Glu Val Glu Gln Leu
   115             120             125

Arg His Tyr Ile Leu Ala Glu Asp Tyr His Gln Asp Tyr Leu Arg Lys
   130             135             140

Asn Pro Ser Gly Tyr Cys His Ile Asp Val Thr Asp Ala Asp Lys Pro
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<212> PRT

<213> Streptococcus pneumoniae

<400> 156

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Met | Lys | Ile | Ile | Val | Pro | Ala | Thr | Ser | Ala | Asn | Ile | Gly | Pro | Gly | Phe |  |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |  |
| Asp | Ser | Val | Gly | Val | Ala | Val | Thr | Lys | Tyr | Leu | Gln | Ile | Glu | Val | Cys |  |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |  |
| Glu | Glu | Arg | Asp | Glu | Trp | Leu | Ile | Glu | His | Gln | Ile | Gly | Lys | Trp | Ile |  |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |  |
| Pro | His | Asp | Glu | Arg | Asn | Leu | Leu | Leu | Lys | Ile | Ala | Leu | Gln | Ile | Val |  |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |  |
| Pro | Asp | Leu | Gln | Pro | Arg | Arg | Leu | Lys | Met | Thr | Ser | Asp | Val | Pro | Leu |  |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |
| Ala | Arg | Gly | Leu | Gly | Ser | Ser | Ser | Ser | Val | Ile | Val | Ala | Gly | Ile | Glu |  |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |  |
| Leu | Ala | Asn | Gln | Leu | Gly | Gln | Leu | Asn | Leu | Ser | Asp | His | Glu | Lys | Leu |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |
| Gln | Leu | Ala | Thr | Lys | Ile | Glu | Gly | His | Pro | Asp | Asn | Val | Ala | Pro | Ala |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |
| Ile | Tyr | Gly | Asn | Leu | Val | Ile | Ala | Ser | Ser | Val | Glu | Gly | Gln | Val | Ser |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |
| Ala | Ile | Val | Ala | Asp | Phe | Pro | Glu | Cys | Asp | Phe | Leu | Ala | Tyr | Ile | Pro |  |
| 145 |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     |     | 160 |  |
| Asn | Tyr | Glu | Leu | Arg | Thr | Arg | Asp | Ser | Arg | Ser | Val | Leu | Pro | Lys | Lys |  |
|     |     |     | 165 |     |     |     |     | 170 |     |     |     |     |     | 175 |     |  |
| Leu | Ser | Tyr | Lys | Glu | Ala | Val | Ala | Ala | Ser | Ser | Ile | Ala | Asn | Val | Ala |  |
|     |     | 180 |     |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |
| Val | Ala | Ala | Leu | Leu | Ala | Gly | Asp | Met | Val | Thr | Ala | Gly | Gln | Ala | Ile |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |
| Glu | Gly | Asp | Leu | Phe | His | Glu | Arg | Tyr | Arg | Gln | Asp | Leu | Val | Arg | Glu |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |
| Phe | Ala | Met | Ile | Lys | Gln | Val | Thr | Lys | Glu | Asn | Gly | Ala | Tyr | Ala | Thr |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |
| Tyr | Leu | Ser | Gly | Ala | Gly | Pro | Thr | Val | Met | Val | Leu | Ala | Ser | His | Asp |  |
|     |     |     | 245 |     |     |     |     |     | 250 |     |     |     |     | 255 |     |  |
| Lys | Met | Pro | Thr | Ile | Lys | Ala | Glu | Leu | Glu | Lys | Gln | Pro | Phe | Lys | Gly |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |
| Lys | Leu | His | Asp | Leu | Arg | Val | Asp | Thr | Gln | Gly | Val | Arg | Val | Glu | Ala |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |

# Lys

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 <212> DNA  
 <213> Streptococcus pneumoniae

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 gtctatcaag ctttaaaggt ttctactcct tttgcgattg agacattcgc tcccaattta 180  
 gagaattttt tagaaaagta caaggaaaat gaagccagag agcttgaaca cccgatttta 240  
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 gtctctcatc gaaatgatca ggttttggaa attttagaaa aaacctctat agcagcttat 360  
 tttacagaag tgggtgacttc tagctcaggc ttttaagagaa agccaaatcc cgaatccatg 420  
 ctttatattaa gagaaaagta tcagattagc tctggtcttg tcattgggtga tcggccgatt 480  
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<210> 158  
 <211> 187  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 158  
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 Gly Ile Thr Gln Asp His Asp Ser Val Tyr Gln Ala Leu Lys Val Ser  
 35 40 45  
 Thr Pro Phe Ala Ile Glu Thr Phe Ala Pro Asn Leu Glu Asn Phe Leu  
 50 55 60  
 Glu Lys Tyr Lys Glu Asn Glu Ala Arg Glu Leu Glu His Pro Ile Leu  
 65 70 75 80  
 Phe Glu Gly Val Ser Asp Leu Leu Glu Asp Ile Ser Asn Gln Gly Gly  
 85 90 95  
 Arg His Phe Leu Val Ser His Arg Asn Asp Gln Val Leu Glu Ile Leu  
 100 105 110  
 Glu Lys Thr Ser Ile Ala Ala Tyr Phe Thr Glu Val Val Thr Ser Ser  
 115 120 125  
 Ser Gly Phe Lys Arg Lys Pro Asn Pro Glu Ser Met Leu Tyr Leu Arg  
 130 135 140

Glu Lys Tyr Gln Ile Ser Ser Gly Leu Val Ile Gly Asp Arg Pro Ile  
 145 150 155 160

Asp Ile Glu Ala Gly Gln Ala Ala Gly Leu Asp Thr His Leu Phe Thr  
 165 170 175

Ser Ile Val Asn Leu Arg Gln Val Leu Asp Ile  
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<210> 159

<211> 1875

<212> DNA

<213> Streptococcus pneumoniae

<400> 159

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  1875

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<210> 160

<211> 624

<212> PRT

<213> Streptococcus pneumoniae

<400> 160

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Thr | Glu | Glu | Ile | Lys | Asn | Leu | Gln | Ala | Gln | Asp | Tyr | Asp | Ala | Ser | 1   | 5   | 10  | 15  |
| Gln | Ile | Gln | Val | Leu | Glu | Gly | Leu | Glu | Ala | Val | Arg | Met | Arg | Pro | Gly | 20  | 25  | 30  |     |
| Met | Tyr | Ile | Gly | Ser | Thr | Ser | Lys | Glu | Gly | Leu | His | His | Leu | Val | Trp | 35  | 40  | 45  |     |
| Glu | Ile | Val | Asp | Asn | Ser | Ile | Asp | Glu | Ala | Leu | Ala | Gly | Phe | Ala | Ser | 50  | 55  | 60  |     |
| His | Ile | Gln | Val | Phe | Ile | Glu | Pro | Asp | Asp | Ser | Ile | Thr | Val | Val | Asp | 65  | 70  | 75  | 80  |
| Asp | Gly | Arg | Gly | Ile | Pro | Val | Asp | Ile | Gln | Glu | Lys | Thr | Gly | Arg | Pro | 85  | 90  | 95  |     |
| Ala | Val | Glu | Thr | Val | Phe | Thr | Val | Leu | His | Ala | Gly | Gly | Lys | Phe | Gly | 100 | 105 | 110 |     |
| Gly | Gly | Gly | Tyr | Lys | Val | Ser | Gly | Gly | Leu | His | Gly | Val | Gly | Ser | Ser | 115 | 120 | 125 |     |
| Val | Val | Asn | Ala | Leu | Ser | Thr | Gln | Leu | Asp | Val | His | Val | His | Lys | Asn | 130 | 135 | 140 |     |
| Gly | Lys | Ile | His | Tyr | Gln | Glu | Tyr | Arg | Arg | Gly | His | Val | Val | Ala | Asp | 145 | 150 | 155 | 160 |
| Leu | Glu | Ile | Val | Gly | Asp | Thr | Asp | Lys | Thr | Gly | Thr | Thr | Val | His | Phe | 165 | 170 | 175 |     |
| Thr | Pro | Asp | Pro | Lys | Ile | Phe | Thr | Glu | Thr | Thr | Ile | Phe | Asp | Phe | Asp | 180 | 185 | 190 |     |
| Lys | Leu | Asn | Lys | Arg | Ile | Gln | Glu | Leu | Ala | Phe | Leu | Asn | Arg | Gly | Leu | 195 | 200 | 205 |     |
| Gln | Ile | Ser | Ile | Thr | Asp | Lys | Arg | Gln | Gly | Leu | Glu | Gln | Thr | Lys | His | 210 | 215 | 220 |     |
| Tyr | His | Tyr | Glu | Gly | Gly | Ile | Ala | Ser | Tyr | Val | Glu | Tyr | Ile | Asn | Glu | 225 | 230 | 235 | 240 |
| Asn | Lys | Asp | Val | Ile | Phe | Asp | Thr | Pro | Ile | Tyr | Thr | Asp | Gly | Glu | Met | 245 | 250 | 255 |     |
| Asp | Asp | Ile | Thr | Val | Glu | Val | Ala | Met | Gln | Tyr | Thr | Thr | Gly | Tyr | His | 260 | 265 | 270 |     |
| Glu | Asn | Val | Met | Ser | Phe | Ala | Asn | Asn | Ile | His | Thr | His | Glu | Gly | Gly | 275 | 280 | 285 |     |
| Thr | His | Glu | Gln | Gly | Phe | Arg | Thr | Ala | Leu | Thr | Arg | Val | Ile | Asn | Asp | 290 | 295 | 300 |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Tyr | Ala | Arg | Lys | Asn | Lys | Leu | Leu | Lys | Asp | Asn | Glu | Asp | Asn | Leu | Thr | 305 | 310 | 315 | 320 |
| Gly | Glu | Asp | Val | Arg | Glu | Gly | Leu | Thr | Ala | Val | Ile | Ser | Val | Lys | His | 325 | 330 | 335 |     |
| Pro | Asn | Pro | Gln | Phe | Glu | Gly | Gln | Thr | Lys | Thr | Lys | Leu | Gly | Asn | Ser | 340 | 345 | 350 |     |
| Glu | Val | Val | Lys | Ile | Thr | Asn | Arg | Leu | Phe | Ser | Glu | Ala | Phe | Ser | Asp | 355 | 360 | 365 |     |
| Phe | Leu | Met | Glu | Asn | Pro | Gln | Ile | Ala | Lys | Arg | Ile | Val | Glu | Lys | Gly | 370 | 375 | 380 |     |
| Ile | Leu | Ala | Ala | Lys | Ala | Arg | Val | Ala | Ala | Lys | Arg | Ala | Arg | Glu | Val | 385 | 390 | 395 | 400 |
| Thr | Arg | Lys | Lys | Ser | Gly | Leu | Glu | Ile | Ser | Asn | Leu | Pro | Gly | Lys | Leu | 405 | 410 | 415 |     |
| Ala | Asp | Cys | Ser | Ser | Asn | Asn | Pro | Ala | Glu | Thr | Glu | Leu | Phe | Ile | Val | 420 | 425 | 430 |     |
| Glu | Gly | Asp | Ser | Ala | Gly | Gly | Ser | Ala | Lys | Ser | Gly | Arg | Asn | Arg | Glu | 435 | 440 | 445 |     |
| Phe | Gln | Ala | Ile | Leu | Pro | Ile | Arg | Gly | Lys | Ile | Leu | Asn | Val | Glu | Lys | 450 | 455 | 460 |     |
| Ala | Ser | Met | Asp | Lys | Ile | Leu | Ala | Asn | Glu | Glu | Ile | Arg | Ser | Leu | Phe | 465 | 470 | 475 | 480 |
| Thr | Ala | Met | Gly | Thr | Gly | Phe | Gly | Ala | Glu | Phe | Asp | Val | Ser | Lys | Ala | 485 | 490 | 495 |     |
| Arg | Tyr | Gln | Lys | Leu | Val | Leu | Met | Thr | Asp | Ala | Asp | Val | Asp | Gly | Ala | 500 | 505 | 510 |     |
| His | Ile | Arg | Thr | Leu | Leu | Leu | Thr | Leu | Ile | Tyr | Arg | Tyr | Met | Lys | Pro | 515 | 520 | 525 |     |
| Ile | Leu | Glu | Ala | Gly | Tyr | Val | Tyr | Ile | Ala | Gln | Pro | Pro | Ile | Tyr | Gly | 530 | 535 | 540 |     |
| Val | Lys | Val | Gly | Ser | Glu | Ile | Lys | Glu | Tyr | Ile | Gln | Pro | Gly | Ala | Asp | 545 | 550 | 555 | 560 |
| Gln | Glu | Ile | Lys | Leu | Gln | Glu | Ala | Leu | Ala | Arg | Tyr | Ser | Glu | Gly | Arg | 565 | 570 | 575 |     |
| Thr | Lys | Pro | Thr | Ile | Gln | Arg | Tyr | Lys | Gly | Leu | Gly | Glu | Met | Asp | Asp | 580 | 585 | 590 |     |
| His | Gln | Leu | Trp | Glu | Thr | Thr | Met | Asp | Pro | Glu | His | Arg | Leu | Met | Ala | 595 | 600 | 605 |     |

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<211> 1446  
<212> DNA  
<213> Streptococcus pneumoniae

<400> 161  
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aatcgtttaa atgcgacttc taattactca gaatattcaa tcagtgtcgc tgttttagca 360  
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tctaagagtc agtctttcaa tatctatggt agtggaattg acacctatgg tcctattagt 720  
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agatga 1446

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<211> 481  
<212> PRT  
<213> Streptococcus pneumoniae

<400> 162  
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Leu Phe Leu Ile Phe Lys Tyr Asn Ile Leu Ala Phe Arg Tyr Leu Asn  
35 40 45  
Leu Val Val Thr Ala Leu Val Leu Leu Val Ala Leu Val Gly Leu Leu

| 50   | 55 | 60 |
|--|----|----|
| Leu Ile Ile Tyr Lys Lys Ala Glu Lys Phe Thr Ile Phe Leu Leu Val<br>65 70 75 80     |    |    |
| Phe Ser Ile Leu Val Ser Ser Val Ser Leu Phe Ala Val Gln Gln Phe<br>85 90 95        |    |    |
| Val Gly Leu Thr Asn Arg Leu Asn Ala Thr Ser Asn Tyr Ser Glu Tyr<br>100 105 110     |    |    |
| Ser Ile Ser Val Ala Val Leu Ala Asp Ser Glu Ile Glu Asn Val Thr<br>115 120 125     |    |    |
| Gln Leu Thr Ser Val Thr Ala Pro Thr Gly Thr Asn Asn Glu Asn Ile<br>130 135 140     |    |    |
| Gln Lys Leu Leu Ala Asp Ile Lys Ser Ser Gln Asn Thr Asp Leu Thr<br>145 150 155 160 |    |    |
| Val Asn Gln Ser Ser Ser Tyr Leu Ala Ala Tyr Lys Ser Leu Ile Ala<br>165 170 175     |    |    |
| Gly Glu Thr Lys Ala Ile Val Leu Asn Ser Val Phe Glu Asn Ile Ile<br>180 185 190     |    |    |
| Glu Ser Glu Tyr Pro Asp Tyr Ala Ser Lys Ile Lys Lys Ile Tyr Thr<br>195 200 205     |    |    |
| Lys Gly Phe Thr Lys Lys Val Glu Ala Pro Lys Thr Ser Lys Ser Gln<br>210 215 220     |    |    |
| Ser Phe Asn Ile Tyr Val Ser Gly Ile Asp Thr Tyr Gly Pro Ile Ser<br>225 230 235 240 |    |    |
| Ser Val Ser Arg Ser Asp Val Asn Ile Leu Met Thr Val Asn Arg Asp<br>245 250 255     |    |    |
| Thr Lys Lys Ile Leu Leu Thr Thr Thr Pro Arg Asp Ala Tyr Val Pro<br>260 265 270     |    |    |
| Ile Ala Asp Gly Gly Asn Asn Gln Lys Asp Lys Leu Thr His Ala Gly<br>275 280 285     |    |    |
| Ile Tyr Gly Val Asp Ser Ser Ile His Thr Leu Glu Asn Leu Tyr Gly<br>290 295 300     |    |    |
| Val Asp Ile Asn Tyr Tyr Val Arg Leu Asn Phe Thr Ser Phe Leu Lys<br>305 310 315 320 |    |    |
| Leu Ile Asp Leu Leu Gly Gly Ile Asp Val Tyr Asn Asp Gln Glu Phe<br>325 330 335     |    |    |
| Thr Ala His Thr Asn Gly Lys Tyr Tyr Pro Ala Gly Asn Val His Leu<br>340 345 350     |    |    |
| Asp Ser Glu Gln Ala Leu Gly Phe Val Arg Glu Arg Tyr Ser Leu Ala                    |    |    |



|   |     |     |     |     |
|---|-----|-----|-----|-----|
| 355   |     | 360 |     | 365 |
| Asp Gly Asp Arg Asp Arg Gly Arg His Gln Gln Lys Val Ile Val Ala |     |     |     |     |
| 370   |     | 375 |     | 380 |
| Ile Leu Gln Lys Leu Thr Ser Thr Glu Val Leu Lys Asn Tyr Ser Thr |     |     |     |     |
| 385   |     | 390 |     | 395 |
|   |     |     |     | 400 |
| Ile Ile Asn Ser Leu Gln Asp Ser Ile Gln Thr Asn Met Pro Leu Glu |     |     |     |     |
|   | 405 |     | 410 | 415 |
| Thr Met Ile Asn Leu Val Asn Ala Gln Leu Glu Ser Gly Gly Asn Tyr |     |     |     |     |
|   | 420 |     | 425 | 430 |
| Lys Val Asn Ser Gln Asp Leu Lys Gly Thr Gly Arg Met Asp Leu Pro |     |     |     |     |
|   | 435 |     | 440 | 445 |
| Ser Tyr Ala Met Pro Asp Ser Asn Leu Tyr Val Met Glu Ile Asp Asp |     |     |     |     |
|   | 450 |     | 455 | 460 |
| Ser Ser Leu Ala Val Val Lys Ala Ala Ile Gln Asp Val Met Glu Gly |     |     |     |     |
| 465   |     | 470 |     | 475 |
|   |     |     |     | 480 |

Arg

<210> 163  
 <211> 732  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 163  
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 tctcacggtc gcaagggcat gtttgaaact ccggaagaga agatagcaga aaacttttctt 180  
 caggttcggg aaatagctaa ggaagtggcg agtgacttgg tcattgctta cggggctgaa 240  
 atttattaca caccagatgt tctggataag ctggaaaaaa agcggattcc gaccctcaat 300  
 gatagtcgtt atgccttgat agagtttagt atgaacactc cttatcgca tattcatagc 360  
 gccttgagca agatcttgat gttgggaatt actccagtca ttgccacat tgagcgctat 420  
 gatgctcttg aaaataatga aaaacgcgtt cgagaactga tcgatatggg ctgttacacg 480  
 caagtaaata gttcacatgt cctcaaacc aaactttttg gcgaacgtta taaattcatg 540  
 aaaaaagag ctcatgattt tttagagcag gatttggttc atgtcattgc aagtgatatg 600  
 cacaatctag acggtagacc tcctcatatg gcagaagcat atgaccttgt taccctcaaaa 660  
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 caactaattt ag 732

<210> 164  
 <211> 243  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 164  
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 Gly Val Arg Thr Ile Val Ser Thr Ser His Arg Arg Lys Gly Met Phe  
                   35                  40                  45  
 Glu Thr Pro Glu Glu Lys Ile Ala Glu Asn Phe Leu Gln Val Arg Glu  
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 Ile Ala Lys Glu Val Ala Ser Asp Leu Val Ile Ala Tyr Gly Ala Glu  
                   65                  70                  75                  80  
 Ile Tyr Tyr Thr Pro Asp Val Leu Asp Lys Leu Glu Lys Lys Arg Ile  
                   85                  90                  95  
 Pro Thr Leu Asn Asp Ser Arg Tyr Ala Leu Ile Glu Phe Ser Met Asn  
                   100                  105                  110  
 Thr Pro Tyr Arg Asp Ile His Ser Ala Leu Ser Lys Ile Leu Met Leu  
                   115                  120                  125  
 Gly Ile Thr Pro Val Ile Ala His Ile Glu Arg Tyr Asp Ala Leu Glu  
                   130                  135                  140  
 Asn Asn Glu Lys Arg Val Arg Glu Leu Ile Asp Met Gly Cys Tyr Thr  
                   145                  150                  155                  160  
 Gln Val Asn Ser Ser His Val Leu Lys Pro Lys Leu Phe Gly Glu Arg  
                   165                  170                  175  
 Tyr Lys Phe Met Lys Lys Arg Ala Gln Tyr Phe Leu Glu Gln Asp Leu  
                   180                  185                  190  
 Val His Val Ile Ala Ser Asp Met His Asn Leu Asp Gly Arg Pro Pro  
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 His Met Ala Glu Ala Tyr Asp Leu Val Thr Gln Lys Tyr Gly Glu Ala  
                   210                  215                  220  
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<210> 165

<211> 3990

<212> DNA

<213> Streptococcus pneumoniae

<400> 165

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 ggatttgcct tccaagcaca gactgttgca gccgatggag ttactcctac tactacagaa 180

|             |             |            |             |             |             |      |
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| aaccaaccga  | ccatccatac  | ggtttctgat | tccccctcaat | catccgaaaa  | tcggactgag  | 240  |
| gaaacaccta  | aagcagtgtc  | tcaaccagaa | gctccaaaaa  | ctgtagaaac  | agaaactcca  | 300  |
| gctactgata  | aggtagctag  | tcttccaaaa | acagaagaaa  | aaccacaaga  | ggaagttagt  | 360  |
| tcaactccta  | gtgataaagc  | agaagtggta | actccaactt  | ctgctgaaaa  | agaaactgct  | 420  |
| aataaaaaagg | cagaagaagc  | tagccctaaa | aaggaagaag  | cgaaagaggt  | tgattctaaa  | 480  |
| gagtcaaata  | cagacaagac  | tgacaaggat | aaaccagcta  | aaaaagatga  | agcgaaagca  | 540  |
| gaggctgaca  | aaccggcaac  | agaggcagga | aaggaacgtg  | ctgcaactgt  | aaatgaaaaa  | 600  |
| ctagcgaaaa  | agaaaattgt  | ttctattgat | gctggacgta  | aatattttctc | accagaacag  | 660  |
| ctcaaggaaa  | tcacgataa   | agcgaaacat | tatggctaca  | ctgattttaca | cctatttagtc | 720  |
| ggaaatgatg  | gactccgttt  | catgttggac | gatatgagca  | tcacagctaa  | cggcaagacc  | 780  |
| tatgccagtg  | acgatgtcaa  | acgcgccatt | gaaaaaggta  | caaatgatta  | ttacaacgat  | 840  |
| ccaaacggca  | atcacttaac  | agaaagtcaa | atgacagatc  | tgattaacta  | tgccaaagat  | 900  |
| aaaggtatcg  | gtctcattcc  | gacagtaaat | agtcttggtc  | acatggatgc  | gattctcaat  | 960  |
| gccatgaaag  | aattgggaat  | ccaaaaccct | aacttttagct | attttgggaa  | gaaatcagcc  | 1020 |
| cgtactgtcg  | atcttgacaa  | cgaacaagct | gtcgctttta  | caaaagccct  | tatcgacaag  | 1080 |
| tatgtctgctt | atcttcgcaa  | aaagactgaa | atcttcaaca  | tcggacttga  | tgaatatgcc  | 1140 |
| aatgatgcga  | cagatgtctaa | aggttggagt | gtgcttcaag  | ctgataaata  | ctatccaaac  | 1200 |
| gaaggctacc  | ctgtaaaagg  | ctatgaaaaa | tttattgcct  | acgccaatga  | cctcgctcgt  | 1260 |
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| aaccgttata  | ctgcagaaa   | cgtcacggcc | gtaaaagaag  | ctgaaaaagc  | tattcgctct  | 1800 |
| ctcgatagca  | accttagccg  | tgcccaacaa | gatacgattg  | atcaagccat  | tgctaaactt  | 1860 |
| caagaaactg  | tcaacaactt  | gaccttcacg | cctgaagctc  | aaaaagaaga  | agaagctaaa  | 1920 |
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| gtccatctcc  | ttctaggaaa  | tgacggactt | cgctttctac  | tcgatgatat  | gaccattact  | 2100 |
| gccaactcga  | aaacctatgc  | tagttagtac | gttaaaaaag  | ctattatcga  | aggaactaaa  | 2160 |
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| gaatacgcta  | aatctaagga  | catcggtctc | atcccagcta  | ttaacagtcc  | aggtcacatg  | 2280 |
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| aaagtttcaa  | aaacaactat  | ggacttgaaa | aacgaagaag  | cgatgaactt  | tgtaaaagcc  | 2400 |
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| gacgaatacg  | ccaacgatgc  | gactagtgcc | caaggctggg  | actacctcaa  | gtggtatcaa  | 2520 |
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| aatgctctcc  | gcgaagaatt  | agctaaaatt | cctacaaact  | tagaaggata  | tagtaaagaa  | 3060 |
| agtcttgagg  | cccttgacgc  | agctaaaaca | gctctaaatt  | acaacctcaa  | ccgtaataaa  | 3120 |
| caagctgagc  | ttgacacgct  | tgtagccaac | ctaaaagccg  | ctcttcaagg  | cctcaaacca  | 3180 |
| gctgtaactc  | attcaggaag  | cctagatgaa | atgaagtggt  | ctgccaatgt  | tgaaaccaga  | 3240 |
| ccagaactca  | tcacaagaac  | tgaagaaatt | ccatttgaag  | ttatcaagaa  | agaaaaatcct | 3300 |
| aacctcccag  | ccggtcagga  | aaatattatc | acagcaggag  | tcaaagggtga | acgaactcat  | 3360 |
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| accaaagaag  | ttataaacca  | agtgggtgaa | gttggegcctc | ctgtaactca  | caagggtgat  | 3480 |
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| attccattta  | ccacagtgc   | ttgtgaaaat | ccactcttac  | tcaaaggaaa  | aacacaagtc  | 3600 |

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<210> 166

<211> 1329

<212> PRT

<213> Streptococcus pneumoniae

<400> 166

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Val Gly Ala Ala Ser Val Leu Ile Gly Phe Ala Phe Gln Ala Gln Thr
      35               40               45

Val Ala Ala Asp Gly Val Thr Pro Thr Thr Thr Glu Asn Gln Pro Thr
      50               55               60

Ile His Thr Val Ser Asp Ser Pro Gln Ser Ser Glu Asn Arg Thr Glu
      65               70               75               80

Glu Thr Pro Lys Ala Val Leu Gln Pro Glu Ala Pro Lys Thr Val Glu
      85               90               95

Thr Glu Thr Pro Ala Thr Asp Lys Val Ala Ser Leu Pro Lys Thr Glu
     100               105               110

Glu Lys Pro Gln Glu Glu Val Ser Ser Thr Pro Ser Asp Lys Ala Glu
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Val Val Thr Pro Thr Ser Ala Glu Lys Glu Thr Ala Asn Lys Lys Ala
     130               135               140

Glu Glu Ala Ser Pro Lys Lys Glu Glu Ala Lys Glu Val Asp Ser Lys
     145               150               155               160

Glu Ser Asn Thr Asp Lys Thr Asp Lys Asp Lys Pro Ala Lys Lys Asp
     165               170               175

Glu Ala Lys Ala Glu Ala Asp Lys Pro Ala Thr Glu Ala Gly Lys Glu
     180               185               190

Arg Ala Ala Thr Val Asn Glu Lys Leu Ala Lys Lys Lys Ile Val Ser
     195               200               205

Ile Asp Ala Gly Arg Lys Tyr Phe Ser Pro Glu Gln Leu Lys Glu Ile
     210               215               220

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ile | Asp | Lys | Ala | Lys | His | Tyr | Gly | Tyr | Thr | Asp | Leu | His | Leu | Leu | Val | 225 | 230 | 235 | 240 |
| Gly | Asn | Asp | Gly | Leu | Arg | Phe | Met | Leu | Asp | Asp | Met | Ser | Ile | Thr | Ala | 245 | 250 | 255 |     |
| Asn | Gly | Lys | Thr | Tyr | Ala | Ser | Asp | Asp | Val | Lys | Arg | Ala | Ile | Glu | Lys | 260 | 265 | 270 |     |
| Gly | Thr | Asn | Asp | Tyr | Tyr | Asn | Asp | Pro | Asn | Gly | Asn | His | Leu | Thr | Glu | 275 | 280 | 285 |     |
| Ser | Gln | Met | Thr | Asp | Leu | Ile | Asn | Tyr | Ala | Lys | Asp | Lys | Gly | Ile | Gly | 290 | 295 | 300 |     |
| Leu | Ile | Pro | Thr | Val | Asn | Ser | Pro | Gly | His | Met | Asp | Ala | Ile | Leu | Asn | 305 | 310 | 315 | 320 |
| Ala | Met | Lys | Glu | Leu | Gly | Ile | Gln | Asn | Pro | Asn | Phe | Ser | Tyr | Phe | Gly | 325 | 330 | 335 |     |
| Lys | Lys | Ser | Ala | Arg | Thr | Val | Asp | Leu | Asp | Asn | Glu | Gln | Ala | Val | Ala | 340 | 345 | 350 |     |
| Phe | Thr | Lys | Ala | Leu | Ile | Asp | Lys | Tyr | Ala | Ala | Tyr | Phe | Ala | Lys | Lys | 355 | 360 | 365 |     |
| Thr | Glu | Ile | Phe | Asn | Ile | Gly | Leu | Asp | Glu | Tyr | Ala | Asn | Asp | Ala | Thr | 370 | 375 | 380 |     |
| Asp | Ala | Lys | Gly | Trp | Ser | Val | Leu | Gln | Ala | Asp | Lys | Tyr | Tyr | Pro | Asn | 385 | 390 | 395 | 400 |
| Glu | Gly | Tyr | Pro | Val | Lys | Gly | Tyr | Glu | Lys | Phe | Ile | Ala | Tyr | Ala | Asn | 405 | 410 | 415 |     |
| Asp | Leu | Ala | Arg | Ile | Val | Lys | Ser | His | Gly | Leu | Lys | Pro | Met | Ala | Phe | 420 | 425 | 430 |     |
| Asn | Asp | Gly | Ile | Tyr | Tyr | Asn | Ser | Asp | Thr | Ser | Phe | Gly | Ser | Phe | Asp | 435 | 440 | 445 |     |
| Lys | Asp | Ile | Ile | Val | Ser | Met | Trp | Thr | Gly | Gly | Trp | Gly | Gly | Tyr | Asp | 450 | 455 | 460 |     |
| Val | Ala | Ser | Ser | Lys | Leu | Leu | Ala | Glu | Lys | Gly | His | Gln | Ile | Leu | Asn | 465 | 470 | 475 | 480 |
| Thr | Asn | Asp | Ala | Trp | Tyr | Tyr | Val | Leu | Gly | Arg | Asn | Ala | Asp | Gly | Gln | 485 | 490 | 495 |     |
| Gly | Trp | Tyr | Asn | Leu | Asp | Gln | Gly | Leu | Asn | Gly | Ile | Lys | Asn | Thr | Pro | 500 | 505 | 510 |     |
| Ile | Thr | Ser | Val | Pro | Lys | Thr | Glu | Gly | Ala | Asp | Ile | Pro | Ile | Ile | Gly | 515 | 520 | 525 |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Gly | Met | Val | Ala | Ala | Trp | Ala | Asp | Thr | Pro | Ser | Ala | Arg | Tyr | Ser | Pro | 530 | 535 | 540 |
| Ser | Arg | Leu | Phe | Lys | Leu | Met | Arg | His | Phe | Ala | Asn | Ala | Asn | Ala | Glu | 545 | 550 | 555 |
| Tyr | Phe | Ala | Ala | Asp | Tyr | Glu | Ser | Ala | Glu | Gln | Ala | Leu | Asn | Glu | Val | 565 | 570 | 575 |
| Pro | Lys | Asp | Leu | Asn | Arg | Tyr | Thr | Ala | Glu | Ser | Val | Thr | Ala | Val | Lys | 580 | 585 | 590 |
| Glu | Ala | Glu | Lys | Ala | Ile | Arg | Ser | Leu | Asp | Ser | Asn | Leu | Ser | Arg | Ala | 595 | 600 | 605 |
| Gln | Gln | Asp | Thr | Ile | Asp | Gln | Ala | Ile | Ala | Lys | Leu | Gln | Glu | Thr | Val | 610 | 615 | 620 |
| Asn | Asn | Leu | Thr | Leu | Thr | Pro | Glu | Ala | Gln | Lys | Glu | Glu | Glu | Ala | Lys | 625 | 630 | 635 |
| Arg | Glu | Val | Glu | Lys | Leu | Ala | Lys | Asn | Lys | Val | Ile | Ser | Ile | Asp | Ala | 645 | 650 | 655 |
| Gly | Arg | Lys | Tyr | Phe | Thr | Leu | Asn | Gln | Leu | Lys | Arg | Ile | Val | Asp | Lys | 660 | 665 | 670 |
| Ala | Ser | Glu | Leu | Gly | Tyr | Ser | Asp | Val | His | Leu | Leu | Leu | Gly | Asn | Asp | 675 | 680 | 685 |
| Gly | Leu | Arg | Phe | Leu | Leu | Asp | Asp | Met | Thr | Ile | Thr | Ala | Asn | Gly | Lys | 690 | 695 | 700 |
| Thr | Tyr | Ala | Ser | Asp | Asp | Val | Lys | Lys | Ala | Ile | Ile | Glu | Gly | Thr | Lys | 705 | 710 | 715 |
| Ala | Tyr | Tyr | Asp | Asp | Pro | Asn | Gly | Thr | Ala | Leu | Thr | Gln | Ala | Glu | Val | 725 | 730 | 735 |
| Thr | Glu | Leu | Ile | Glu | Tyr | Ala | Lys | Ser | Lys | Asp | Ile | Gly | Leu | Ile | Pro | 740 | 745 | 750 |
| Ala | Ile | Asn | Ser | Pro | Gly | His | Met | Asp | Ala | Met | Leu | Val | Ala | Met | Glu | 755 | 760 | 765 |
| Lys | Leu | Gly | Ile | Lys | Asn | Pro | Gln | Ala | His | Phe | Asp | Lys | Val | Ser | Lys | 770 | 775 | 780 |
| Thr | Thr | Met | Asp | Leu | Lys | Asn | Glu | Glu | Ala | Met | Asn | Phe | Val | Lys | Ala | 785 | 790 | 795 |
| Leu | Ile | Gly | Lys | Tyr | Met | Asp | Phe | Phe | Ala | Gly | Lys | Thr | Lys | Ile | Phe | 805 | 810 | 815 |
| Asn | Phe | Gly | Thr | Asp | Glu | Tyr | Ala | Asn | Asp | Ala | Thr | Ser | Ala | Gln | Gly | 820 | 825 | 830 |

Trp Tyr Tyr Leu Lys Trp Tyr Gln Leu Tyr Gly Lys Phe Ala Glu Tyr  
 835 840 845  
 Ala Asn Thr Leu Ala Ala Met Ala Lys Glu Arg Gly Leu Gln Pro Met  
 850 855 860  
 Ala Phe Asn Asp Gly Phe Tyr Tyr Glu Asp Lys Asp Asp Val Gln Phe  
 865 870 875 880  
 Asp Lys Asp Val Leu Ile Ser Tyr Trp Ser Lys Gly Trp Trp Gly Tyr  
 885 890 895  
 Asn Leu Ala Ser Pro Gln Tyr Leu Ala Ser Lys Gly Tyr Lys Phe Leu  
 900 905 910  
 Asn Thr Asn Gly Asp Trp Tyr Tyr Ile Leu Gly Gln Lys Pro Glu Asp  
 915 920 925  
 Gly Gly Gly Phe Leu Lys Lys Ala Ile Glu Asn Thr Gly Lys Thr Pro  
 930 935 940  
 Phe Asn Gln Leu Ala Ser Thr Lys Tyr Pro Glu Val Asp Leu Pro Thr  
 945 950 955 960  
 Val Gly Ser Met Leu Ser Ile Trp Ala Asp Arg Pro Ser Ala Glu Tyr  
 965 970 975  
 Lys Glu Glu Glu Ile Phe Glu Leu Met Thr Ala Phe Ala Asp His Asn  
 980 985 990  
 Lys Asp Tyr Phe Arg Ala Asn Tyr Asn Ala Leu Arg Glu Glu Leu Ala  
 995 1000 1005  
 Lys Ile Pro Thr Asn Leu Glu Gly Tyr Ser Lys Glu Ser Leu Glu Ala  
 1010 1015 1020  
 Leu Asp Ala Ala Lys Thr Ala Leu Asn Tyr Asn Leu Asn Arg Asn Lys  
 1025 1030 1035 1040  
 Gln Ala Glu Leu Asp Thr Leu Val Ala Asn Leu Lys Ala Ala Leu Gln  
 1045 1050 1055  
 Gly Leu Lys Pro Ala Val Thr His Ser Gly Ser Leu Asp Glu Asn Glu  
 1060 1065 1070  
 Val Ala Ala Asn Val Glu Thr Arg Pro Glu Leu Ile Thr Arg Thr Glu  
 1075 1080 1085  
 Glu Ile Pro Phe Glu Val Ile Lys Lys Glu Asn Pro Asn Leu Pro Ala  
 1090 1095 1100  
 Gly Gln Glu Asn Ile Ile Thr Ala Gly Val Lys Gly Glu Arg Thr His  
 1105 1110 1115 1120  
 Tyr Ile Ser Val Leu Thr Glu Asn Gly Lys Thr Thr Glu Thr Val Leu  
 1125 1130 1135

Asp Ser Gln Val Thr Lys Glu Val Ile Asn Gln Val Val Glu Val Gly  
 1140 1145 1150  
 Ala Pro Val Thr His Lys Gly Asp Glu Ser Gly Leu Ala Pro Thr Thr  
 1155 1160 1165  
 Glu Val Lys Pro Arg Leu Asp Ile Gln Glu Glu Glu Ile Pro Phe Thr  
 1170 1175 1180  
 Thr Val Thr Cys Glu Asn Pro Leu Leu Leu Lys Gly Lys Thr Gln Val  
 1185 1190 1195 1200  
 Ile Thr Lys Gly Val Asn Gly His Arg Ser Asn Phe Tyr Ser Val Ser  
 1205 1210 1215  
 Thr Ser Ala Asp Gly Lys Glu Val Lys Thr Leu Val Asn Ser Val Val  
 1220 1225 1230  
 Ala Gln Glu Ala Val Thr Gln Ile Val Glu Val Gly Thr Met Val Thr  
 1235 1240 1245  
 His Val Gly Asp Glu Asn Gly Gln Ala Ala Ile Ala Glu Glu Lys Pro  
 1250 1255 1260  
 Lys Leu Glu Ile Pro Ser Gln Pro Ala Pro Ser Thr Ala Pro Ala Glu  
 1265 1270 1275 1280  
 Glu Ser Lys Val Leu Pro Gln Asp Pro Ala Pro Val Val Thr Glu Lys  
 1285 1290 1295  
 Lys Leu Pro Glu Thr Gly Thr His Asp Ser Ala Gly Leu Val Val Ala  
 1300 1305 1310  
 Gly Leu Met Ser Thr Leu Ala Ala Tyr Gly Leu Thr Lys Arg Lys Glu  
 1315 1320 1325

Asp

<210> 167  
 <211> 825  
 <212> DNA  
 <213> Streptococcus pneumoniae

<400> 167  
 atgaacaaaa aaacaagaca gacactaatc ggactgctag tggtattgct tttgtctaca 60  
 gggagctatt atatcaagca gatgccgtcg gcacctaata gtcccaaaac caatcttagt 120  
 cagaaaaaac aagcgtctga agctcctagt caagcattgg cagagagtgt cttaacagac 180  
 gcagtcaaga gtcaataaaa ggggagtctg gagtggaatg gctcaggtgc ttttatcgctc 240  
 aatggtaata aaacaaatct agatgccaaag gtttcaagta agccctacgc tgacaataaaa 300  
 acaagacag tgggcaagga aactgttcca accgtagcta atgccctctt gtctaaggcc 360  
 actcgtcagt acaagaatcg taaagaaact gggaatggtt caacttcttg gactcctcca 420  
 ggttggcatc aggtcaagaa tctaaagggc tcttataccc atgcagtcga tagagggtcat 480  
 ttgttaggct atgccttaat cgggtggtttg gatgggtttg atgcctcaac aagcaatcct 540  
 aaaaacattg ctgttcagac agcctgggca aatcaggcac aagccgagta ttcgactggt 600



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caaaactact atgaaagcaa ggtgcgtaaa gccttggacc aaaacaagcg tgtccgttac 660
cgtgtaaccc ttactacgc ttcaaacgag gatttagttc cctcagcttc acagattgaa 720
gccaaagtctt cggatggaga attggaattc aatgttctag ttcccaatgt tcaaaaggga 780
cttcaactgg attaccgaac tggagaagta actgtaactc agtaa 825

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<210> 168
<211> 274
<212> PRT
<213> Streptococcus pneumoniae

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<400> 168
Met Asn Lys Lys Thr Arg Gln Thr Leu Ile Gly Leu Leu Val Leu Leu
  1             5             10             15

Leu Leu Ser Thr Gly Ser Tyr Tyr Ile Lys Gln Met Pro Ser Ala Pro
      20             25             30

Asn Ser Pro Lys Thr Asn Leu Ser Gln Lys Lys Gln Ala Ser Glu Ala
      35             40             45

Pro Ser Gln Ala Leu Ala Glu Ser Val Leu Thr Asp Ala Val Lys Ser
      50             55             60

Gln Ile Lys Gly Ser Leu Glu Trp Asn Gly Ser Gly Ala Phe Ile Val
      65             70             75             80

Asn Gly Asn Lys Thr Asn Leu Asp Ala Lys Val Ser Ser Lys Pro Tyr
      85             90             95

Ala Asp Asn Lys Thr Lys Thr Val Gly Lys Glu Thr Val Pro Thr Val
      100            105            110

Ala Asn Ala Leu Leu Ser Lys Ala Thr Arg Gln Tyr Lys Asn Arg Lys
      115            120            125

Glu Thr Gly Asn Gly Ser Thr Ser Trp Thr Pro Pro Gly Trp His Gln
      130            135            140

Val Lys Asn Leu Lys Gly Ser Tyr Thr His Ala Val Asp Arg Gly His
      145            150            155            160

Leu Leu Gly Tyr Ala Leu Ile Gly Gly Leu Asp Gly Phe Asp Ala Ser
      165            170            175

Thr Ser Asn Pro Lys Asn Ile Ala Val Gln Thr Ala Trp Ala Asn Gln
      180            185            190

Ala Gln Ala Glu Tyr Ser Thr Gly Gln Asn Tyr Tyr Glu Ser Lys Val
      195            200            205

Arg Lys Ala Leu Asp Gln Asn Lys Arg Val Arg Tyr Arg Val Thr Leu
      210            215            220

Tyr Tyr Ala Ser Asn Glu Asp Leu Val Pro Ser Ala Ser Gln Ile Glu
      225            230            235            240

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Ala Lys Ser Ser Asp Gly Glu Leu Glu Phe Asn Val Leu Val Pro Asn  
245 250 255

Val Gln Lys Gly Leu Gln Leu Asp Tyr Arg Thr Gly Glu Val Thr Val  
260 265 270

Thr Gln

<210> 169

<211> 225

<212> DNA

<213> Streptococcus pneumoniae

<400> 169

gtgctaagat tcagcggatt gaggcaagtg atgaagatga ataagaaatc aagctacgta 60  
gtcaagecgtt tacttttagt catcatagta ctgatttttag gtactctggc tctaggaatc 120  
ggtttaaatgg taggttatgg aatcttgggc aaggggtcaag atccatgggc tatcctgtct 180  
ccagcaaaat ggcaggaatt gattcataaa ttacaggaa attag 225

<210> 170

<211> 74

<212> PRT

<213> Streptococcus pneumoniae

<400> 170

Val Leu Arg Phe Ser Gly Leu Arg Gln Val Met Lys Met Asn Lys Lys  
1 5 10 15

Ser Ser Tyr Val Val Lys Arg Leu Leu Leu Val Ile Ile Val Leu Ile  
20 25 30

Leu Gly Thr Leu Ala Leu Gly Ile Gly Leu Met Val Gly Tyr Gly Ile  
35 40 45

Leu Gly Lys Gly Gln Asp Pro Trp Ala Ile Leu Ser Pro Ala Lys Trp  
50 55 60

Gln Glu Leu Ile His Lys Phe Thr Gly Asn  
65 70

<210> 171

<211> 40

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 171

cgagatctga tatctcacia acagataacg gcgtaaatag

<210> 172  
 <211> 43  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 172  
 gaagatcttc cccgggatca caaacagata acggcgtaaa tag 43  
  
 <210> 173  
 <211> 42  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 173  
 cgagatctga tatccatcac aaacagataa cggcgtaaag ag 42  
  
 <210> 174  
 <211> 32  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 174  
 cgggatacctt atggacctga atcagcgttg tc 32  
  
 <210> 175  
 <211> 23  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 175  
 ggatgctttg tttcaggtgt atc 23  
  
 <210> 176  
 <211> 82  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer

<400> 176  
catgatatcg gtacctcaag ctcatatcat tgtccggcaa tgggtgtgggc tttttttgtt 60  
ttagcggata acaatttcac ac 82

<210> 177  
<211> 81  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: Primer

<400> 177  
gcggatcccc cgggcttaat taatgtttaa acactagtcg aagatctcgc gaattctcct 60  
gtgtgaaatt gttatccgct a 81

<210> 178  
<211> 24  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: Primer

<400> 178  
cgccagggtt ttcccagtcg cgac 24

<210> 179  
<211> 20  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: Primer

<400> 179  
tcaggggggc ggagcctatg 20

<210> 180  
<211> 22  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: Primer

<400> 180  
tcgtatgttg tgtggaattg tg 22

<210> 181  
<211> 26  
<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 181

tccggctcgt atgttggtg gaattg

26

<210> 182

<211> 5

<212> PRT

<213> Artificial Sequence

<220>

<221> SITE

<222> (3)

<223> Xaa=Any amino acid

<220>

<223> Description of Artificial Sequence: Cell wall  
anchoring motif

<400> 182

Leu Pro Xaa Thr Gly

1

5

<210> 183

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 183

gcgggatccg ccaccatg

18

<210> 184

<211> 10

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 184

ttgcggccgc

10

<210> 185

<211> 43

<212> DNA

<213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 185  
 cggatccgcc accatgggtc taattgaaga cttaaaaaat caa 43  
  
 <210> 186  
 <211> 36  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 186  
 ttgcggccgc caatgctaga ctaaacacaa gactca 36  
  
 <210> 187  
 <211> 36  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 187  
 cgcggatcca tgaaaaaat ctattcattt ttagca 36  
  
 <210> 188  
 <211> 38  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 188  
 ccctcgaggg ctacttccga tacattttaa actgtagg 38  
  
 <210> 189  
 <211> 35  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 189  
 cggatccgcc accatgagtc atgtcgctgc aaatg 35  
  
 <210> 190

<211> 32  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 190  
 ttgcggccgc ataccaaacg ctgacatcta cg 32  
  
 <210> 191  
 <211> 38  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 191  
 cggatccgcc accatgcaaa aagagcggta tggttatg 38  
  
 <210> 192  
 <211> 30  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 192  
 ttgcggccgc acccccattc ttaatccctt 30  
  
 <210> 193  
 <211> 40  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 193  
 cggatccgcc accatggagg tatgtgaaat gtcacgtaaa 40  
  
 <210> 194  
 <211> 32  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence: Primer  
  
 <400> 194  
 ttgcggccgc ttttaciaag tcaagcaaag cc 32

<210> 195  
<211> 48  
<212> PRT  
<213> Streptococcus pneumoniae

<400> 195  
Gly Ile Arg Leu Arg Asn Met Leu Phe Lys Ile Trp Pro Ala Val Ala  
1 5 10 15  
Leu Val Thr Ser Ser Gly Asn Asn Val Ser Met Leu His Ser Ile Ala  
20 25 30  
Asn Met Gly Gln Leu Thr Leu Gly Thr Gln Cys Gln Thr Val Val Val  
35 40 45

<210> 196  
<211> 11  
<212> PRT  
<213> Streptococcus pneumoniae

<400> 196  
Gln Lys Ile Thr Met Ile Thr Phe Thr Phe Gln  
1 5 10

<210> 197  
<211> 4  
<212> PRT  
<213> Artificial Sequence

<220>  
<221> SITE  
<222> (2-3)  
<223> Xaa=Any amino acid

<220>  
<223> Description of Artificial Sequence: Ipoprotein attachment sites

<400> 197  
Leu Xaa Xaa Cys  
1